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TO THE SOUTH POLAR REGIONS.

A SOUTH POLAR SUMMER SCENE AMID THE ICE.

TO THE

SOUTH POLAR REGIONS

EXPEDITION OF 1898-1900

BY

LOUIS BERNACCHI, F.R.G.S.

ILLUSTRATED FROM PHOTOGRAPHS
TAKEN BY THE AUTHOR

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TO THE MEMORY OF MY COMPANIONS:—

NICOLAI HANSON (ZOOLOGIST),

HERLUF KLÖVSTAD, M.A., M.D. (MEDICAL OFFICER),

JØRGEN PETERSEN (FIRST MATE),

WHO LOST THEIR LIVES IN THE INTERESTS OF

SCIENCE AND GEOGRAPHICAL RESEARCH,

THIS BOOK IS DEDICATED.

PREFACE.

In the following pages an attempt has been made to give an account of the cruise of the ship *Southern Cross* to the South Polar Seas, and of the first winter ever spent on Antarctic shores. The aim of this book is to present to the general reader a simple account of our experiences and of the phenomena witnessed in those little-known regions. The recorded minutiæ of monotonous months have been, as far as possible, avoided. So that it is hoped these pages may be read without weariness and, perhaps, with a certain amount of profit, for although in no way a scientific narrative of the voyage, great care has been taken to make any scientific information and fresh facts as accurate as possible. The scientific results of the expedition have been published elsewhere, but a short account of some of the results obtained is given at the end of this volume, and may prove of interest to some readers. It is, no doubt, extremely difficult to sustain interest in a narrative dealing with a locality so barren and devoid of life.

To ordinary readers the most desolate region imaginable is that within the Arctic Circle. Yet the intrepid explorers who have furthest penetrated into the northern wilds, encountered there bears, wolves, musk oxen, walrus, seals and other mammals, and saw flocks of birds steering northwards beyond the utmost limit of discovery. Infinitely more desolate are the mysterious Antarctic regions. Enveloped in an atmosphere of universal death, wrapped in its closely-clinging cerements of ice and snow, the one expression of the Antarctica of to-day is that of lifeless silence. If, in the domain of Nature, such another region is to be found, it can only be in the

heart of those awful solitudes which science has unveiled to us amid the untrodden fastnesses of the lunar mountains. Life in the Antarctic is one of hardship, privation, monotony and isolation, but it has a subtle charm which is indefinable, and you look back with a vivid and a lingering recollection to those days spent in geographical and scientific research near the South Pole.

The Antarctic Expedition of 1898-1900 was organised and led by Mr. C. E. Borchgrevink, and the necessary funds, some £40,000, were munificently provided by Sir George Newnes, Bart. The object of the expedition was to spend a winter on shore for the purpose of collecting meteorological and magnetic observations covering an entire year, our knowledge of those conditions being at that time practically *nil*, and for the purpose of adding to our general knowledge of those regions, both scientific and geographical. The ship, upon which in an expedition of this kind so much depends, was an adapted whaler purchased in Norway and re-christened the *Southern Cross*, after that much-quoted constellation near the South Pole. She was small, being only 522 tons gross tonnage, and 147 feet in length, but admirably adapted for navigating in the heavy and dense South Polar ice-packs, where a small ship, answering her helm very readily, is essential. The engines were excellent, being quite new and almost too powerful for the size of the ship.

Most of the equipment and stores were supplied by the Military Equipment Company, Limited, of Waterloo Place, London, and great credit is due to that firm for the very efficient manner in which it carried out its work. Not only does the success of a Polar Expedition largely depend upon its equipments, but the lives of its members are dependent upon the nature, quality, and, to a certain extent, the packing, of the food supplies.

Most of the scientific instruments and photographic apparatus were procured from Messrs. Ross, Ltd., London, and Messrs. Negretti and Zambra, London. The scientific results obtained are a sufficient guarantee of the efficiency of the instruments employed.

I cannot forbear here expressing my sincerest thanks, first of all to Sir George Newnes, for granting me permission to publish

a narrative, and for allowing me to publish some forty Antarctic photographs which have not before appeared; to the President of the Royal Geographical Society, Sir Clements Markham, K.C.B., and to Dr. John Scott Keltie, for their kindly encouragement. Last, but not least, to Mr. William Plank, who, as Private Secretary to Sir George Newnes, had most onerous duties to perform in connection with the Expedition, and to my companions of the voyage; more especially would I mention my old friend, Lieutenant Colbeck, who, I trust, may continue in the work of Antarctic research which he has so ably commenced. On account of my recent appointment as Physicist to the National Antarctic Expedition, and the short time at my disposal, the latter part of the book has been rather hurriedly written and abridged, and not so carefully revised as I could have wished.

LOUIS BERNACCHI.

National and Liberal Club,
London.
Sept. 1901.

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TO THE SOUTH POLAR REGIONS.

PART I.—NARRATIVE.

CHAPTER I.

"We left behind the painted buoy
That tosses at the harbour mouth,
And madly danced our hearts with joy
As fast we fleeted to the south;
How fresh was every sight and sound
On open main and winding shore,
We knew the merry world was round
And we might sail for evermore."

—TENNYSON.

THE ship *Southern Cross* left London on August 22nd, 1898, bound for the frozen solitudes of the South Pole. It was a day ever to be remembered. A day indelibly imprinted upon our minds. A strange conflict of emotions prevailed among the members of the Expedition; excitement, anxiety, expectation, pride, and unutterable sorrow. The sorrow of parting with friends and relatives. The sorrow at leaving old England for so long a period.

The morning was dull and cheerless, but later towards noon the sky cleared and the sun shone forth radiantly.

The interest in the departure was universal. "Are ye goin' with 'er?" said cabby, jerking his head over towards the

ship. "Yes," replied one of the members. "Ye are!" and he looked at him admiringly; "do ye think ye'll ever come back, sir?" "Of course; why not?" "Well, here's luck to ye, sir, and a safe return to old England." And he stood up in his seat and doffed his cap, forgetting in his enthusiasm to examine his fare.

Standing on the quay watching the excitement were some half-dozen "wharf rats." "Where she bound for?" said one, addressing himself to his companions. "Don't ye know? Why, to the South Pole, o' course." "Bah!" said the first speaker, "she'll not come back agen," and he dug his hands deep down into his ragged pockets and spat around knowingly.

At a little after four o'clock all was ready. The pilot came on board, last farewells were said, the lines were cast ashore and the little ship had commenced her long and perilous voyage. Many thousands of people had assembled to witness the departure. There was scarce standing room on the quays. Cheer upon cheer went up from the crowd and we cheered in reply. Slowly the ship glided out of the dock, the Union Jack at the yard arm, the Norwegian flag at the main mast and the flag of the Royal London Yacht Club (under which she sailed) at the mizzen. The whole ship was gaily decorated with bunting. Suddenly some sailors on the quay started up a rollicking sea-song; cheer after cheer burst from the multitude. The ships in the dock blew their whistles and the Union Jack at the yard was dipped continually.

It was a soul-stirring scene.

Down the Thames we slowly steamed, followed by numbers of pleasure boats, whose passengers cheered incessantly. At

Greenwich an immense crowd had congregated, and as we steamed past a mighty roar from thousands of throats came across the waters. On coming abreast of the training ships the yards were manned and three lusty British cheers were accorded us.

At Gravesend came the last and most sorrowful leave takings: somehow it is not a particularly cheerful kind of a place for leave taking, it rather suggests to the mind the quintessence of finality. We sat up on deck most of that night, although it was rather cold and misty. Ever and anon throughout the night one could hear the weird clang of the bell in the Downs sending its solemn notes of warning booming across the deep. Dover was reached early the following morning, where a boat came off for our pilot. A few parting words wishing us success and he was gone.

The Atlantic Ocean treated the *Southern Cross* with great consideration and showed her none of its proverbial bad temper. Beautifully calm warm weather was enjoyed all the way to Madeira, which was sighted on September 3rd, and on the following morning we approached the island; one of the most lovely and verdant scenes that the world can show. Hundreds of fishing boats were passed just outside Funchal, the principal town in Madeira, and the Portuguese fishermen stood up in their boats and waved their hats as we went by. We had no sooner dropped anchor in the harbour of Funchal than we were surrounded by boats full of Custom House officials, boats full of diving boys, of vegetables, of wicker chairs and tables, of parrots, fruits and other articles too numerous to mention. We went on shore as soon as we had gone though the red tape officialism with the Portuguese authorities, and proceeded to the establishment of Mr. Payne,

a Madeira merchant, where we had some exquisite Madeira wine—the genuine article. We then engaged a guide who showed us all the rare beauties of the city and its immediate surroundings. The natural beauty of the place, however, is marred by one thing, viz., the scores of beggars one meets, each afflicted with some peculiar and dreadful deformity or disease.

In the afternoon we made the ascent of a mountain which overlooks the city, or, more correctly speaking, we were carried by a railway train after the style of the Mount Pilatus Railway in Switzerland. The panorama from the top, 2,000 feet above the level of the sea, was singularly grand. There is a very fine hotel on the summit, where we regaled ourselves with a splendid variety of most luscious fruits.

The descent was made in sledges. These sledges are peculiar to Madeira. They are baskets with steel or very hard wood under them and they slide down the stone-paved paths by their own momentum. They travel at a tremendous speed, guided by two skilled Portuguese conductors, each with one foot naked to prevent slipping, who hold the ropes, and when the sledges begin to travel more swiftly than they can follow, mount upon the projecting ends of the runners and are carried with it. It is most exhilarating and exciting. Climbing up the mountain in the ordinary way takes nearly two hours ; the descent is accomplished in about ten minutes.

The rest of the day was spent in strolling in the gardens under the shade of the luxurious vines and the glowing mass of greenery that in this heavenly island makes a garden. Madeira is indeed, grand, a gem of the ocean, the land of milk and honey, of rough mountain grandeur. It is intoxicating. The blue sky overhead, " the vast expanse of intensely blue ocean

H. BLACKWALL EVANS. HERLUF KLÖVSTAD.

MEMBERS OF THE SCIENTIFIC STAFF.

See Page 185 for photograph of the Zoologist, Mr. Nicolai Hanson.

glittering in the sun like myriads of sapphires," the luxurious tropical vegetation and the salubrious indolent climate all conduce to make it so. Life here must be the quintessence of luxury, the acme of laziness.

One can well imagine that it is especially adapted to invalids. They say the winter is the best part of the year, or at least the long spring, for spring and winter enter into one another without any visible change.

We left Madeira of the sunny sky and azure sea the next morning.

St. Cruz was reached on the 7th September. There was nothing of special interest there, so we only stayed a few hours. It was fearfully hot and we were glad to leave the place. We got the N.E. trade winds immediately after leaving Madeira, and passed the tropic of Cancer a few days after. St. Vincent, one of the Cape Verde islands, was next reached, and here we remained a day in order to take in coal and fresh provisions. St. Vincent from the sea has a desolate aspect, and on landing this desolate aspect and lack of verdure are even more apparent. The volcanic fires of past ages and the scorching heat of a tropical sun have deprived it of vegetation.

During our wanderings in the island we met a party of between twenty and thirty negresses, dressed in excellent taste, their black skin and snow-white linen being set off with coloured turbans and large shawls. At a water fountain others were met. They looked most picturesque with water pitchers on their heads and their bright coloured garments. One bonny lass allowed us to photograph her with the pitcher on her head, her arms akimbo, and a merry smile on her lips.

Fresh water has to be purchased by the negroes. An important-looking Portuguese official stands near the fountain and collects the water dues.

The English in the island treated us with great hospitality and courtesy. They showed us whatever was to be seen, and entertained us at a lunch. Soon after leaving St. Vincent some of the members became seriously ill, Mr. Hanson, the zoologist, most dangerously so. His illness lasted over three weeks, at the end of which he was in a most pitiable state of weakness. It was undoubtedly some form of fever, possibly contracted at St. Vincent, which had attacked him. The sickness was aggravated by the intense heat and the appalling effluvium arising from some ninety Siberian sledge dogs we had on deck. These dogs were procured from the Samoyedes, in the north of Siberia, and were the first dogs ever introduced in Antarctic exploration. They were in charge of two Finns, two interesting fellows of singular good nature, who came from Vordsö, in the north of Norway, and who were well versed in the management of dogs and in sledge travelling. It would be advisable on all future Antarctic expeditions, where dogs are employed, to send them on ahead by a fast steamer, as the noise and dirt they make on board a small ship taking three months to reach Australia is well nigh unbearable.

In latitude 10° N. and longitude 25° W. we entered the "Variables," or as it is sometimes called, the "Doldrums," the space between the N.E. and S.E. trades. Here we encountered much rain, calms, and violent head winds. This *Equatorial Belt* is remarkable for its sultry, humid atmosphere, its constant and copious rains, and for the strongly marked diurnal, as contrasted with seasonal, changes.

GREENLAND AND SIBERIAN DOGS ON DECK.

It was now so hot (September 22nd) that it was an undiluted pleasure to do nothing. It was impossible to spend the nights in one's berth, on account of the proximity of the cabins to the engine room. One had, therefore, to resort to a hammock, slung on deck, where you at least procured some fresh air. The nights were very fine. The beautiful constellations of the Southern Cross (Crux) and Orion were now visible and shone with great brilliancy. The planet Venus was a superb object in the evening sky. One rarely sees the planet so advantageously in other climes. The atmosphere is so pellucidly clear that it appears to the eye to be double the size one ordinarily sees it in higher latitudes. It was, indeed, enjoyment to sit out on deck and contemplate the vast fabric of the Universe while the good ship ploughed her way through the Atlantic Ocean; the white foam hissing at her sides. It was, however, very monotonous lumbering along day after day, deeming ourselves fortunate if we made an average run of 150 miles a day. How different to the swift passages of the great racing steamers, which fly across the ocean at something like 400 miles a day. There is very little outside the ship to create excitement. One has nothing to observe but the scenery of the sea; the form of waves and their colour, and the reflection of the clouds above; the sunrise and the sunset, and the shoals of flying fish.

Sunsets in the Tropics are decidedly poor. They lack the gorgeous colouring and beauty witnessed in higher latitudes.

Helios plumps down below the horizon in a lamentably undignified fashion.

The flying fish *(Exocetus Volitans)* which we had with us for many days on both sides of the Equator left us in about

35° South Latitude. These fish are capable of making very considerable flights in the air, their pectoral fins being enormously elongated, and when fully expanded somewhat similar to the wings of an insect. They are met with in shoals in nearly all tropical and sub-tropical seas ; when disturbed by a ship on a calm day they spring out of the sea, expand their fins, describe a regular parabolic curve in the air, and then fall with a splash into the water. A controversy arose some time ago on the use of their fins in this flight through the air, some observers believing that the fins are used only as a kind of parachute, and others that they are used like wings for raising the body above the water. There is very little doubt that the latter theory is correct, for the whirr of the wing-fins is distinctly visible as well as audible.

The sea-birds diversify for some time the immense monotony of the heaving, black wilderness of waters.

We had now (October) the magnificent Great Wanderer Albatross *(Diomedia Exulans)* following in the wake of our ship, also the Sooty Albatross *(Diomedia fuliginosa)* and innumerable numbers of Cape Pigeons *(Daption Capensis)*. Easily first in point of interest as well as size, comes the lordly albatross, whose home is far south of the line, and whose empire is that illimitable area of turbulent waves which sweep resistless round the world. Compared to his power of vision, the piercing gaze of the eagle or condor becomes myoptic. Out of the blue void he comes unhasting on motionless pinions, yet at such a speed that, one moment a speck hardly discernible, turn but your eyes away and ere you can again look round he is gliding majestically overhead. Nothing in Nature conveys to the mind so

THE "SOUTHERN CROSS."

wonderful an idea of effortless velocity as does his calm appearance from vacancy. Like most of the true pelagic birds, he is a devourer of offal, the successful pursuit of fish being impossible to his majestic evolutions. His appetite is enormous, but his powers of abstinence are equally great, and often for days he goes without other nourishment than a drink of bitter sea. At the Gargantuan banquet provided by the carcase of a dead whale, he will gorge himself until incapable of rising from the sea, yet still his angry scream may be heard as if protesting against his inability to find room for more provision against hungry days soon to follow. Despite his incomparable grace of flight when gliding through mid-air with his mighty wings outspread, when on shore or on deck he is clumsy and ill at ease. Even seated upon the sea his proportions appear somewhat ungainly, while his huge hooked beak seems too heavy to be upheld. A true child of the air, land is hateful to him, and only on the wing does he appear to be really at home.

The Sooty Albatross is also very handsome, but of a more sedate plumage. He has pure white circular markings around the eyes, which, contrasted against the darkness of his plumage, give him a very fine appearance.

A general favourite among seamen is the Cape pigeon, a pretty, busy little sea bird about the size of a dove, but plumper, with a black head and an elaborate pattern in black, grey, and white upon its open wings. Around the stern of any passing ship large numbers of these fluttering visitors hover continually, their shrill cries and unweary manœuvres contrasting pleasantly with the deep monotone made by the driving keel through the foaming sea. In common with most Southern sea-birds having hooked beaks, they are easily

caught with hook and line, but will not live in captivity. Thoughtless passengers often amuse themselves by shooting these graceful wanderers, although what satisfaction may be found in reducing a beautiful living thing to a useless morsel of draggled carrion is not easy to see.

At the bottom of the size scale, but in point of affectionate interest second to none, comes the stormy petrel, or Mother Carey's chicken, a darling wee wanderer common in both hemispheres, and beloved by all sailors with its delicate, glossy black and brown plumage, just flecked with white on the open wings, and its long, slender legs reaching out first on one side and then on the other as if to feel the sea, it nestles under the very curl of the most mighty billows, or skims the sides of their green abysses, content as the lark over a lush meadow.

Howling hurricane or searching snow-blasts pass unheeded over that velvety black head. The brave, bright eye dims not, nor does the cheery little note falter. They seem to have solved the secret of perpetual motion, and often at night a careful listener may hear their low cry, even if he be not keen sighted enough to see them flit beneath him. The zoologist was occupied in capturing these sea-birds for the collection. A rather dismal kind of sport. A long line with hook and bait attached, was put over the stern. The unfortunate and unsuspecting bird swoops down upon the apparently tempting bit and is promptly hooked and hauled aboard in a most ignominious manner. He is next executed by means of chloroform and consigned to the taxidermist.

Towards the end of October, when off the Cape of Good Hope, a sharp look-out was kept for icebergs. During the last few years many icebergs have been met in these latitudes

by outward-bound ships to Australia even in the months of September, October, and November.

On November the 2nd we were off the Crozet Islands, where we encountered much drifting kelp (*facus gigantea*). On the following day a furious storm from the N.W. overtook us; the barometer fell one inch; the sea was a wilderness, but the little ship behaved splendidly, although heavy seas broke over her continually. The dogs, however, suffered severely during the storm, being pitched from side to side.

At daylight on November 27th, the Tasmanian Coast was sighted, ninety-seven days after leaving London. What a pleasure, after having been more than three months on the monotonous ocean, to behold land once more—Tasmania, the prettiest and most genial isle in all the world!

How familiar to me were those hilly shores. As we approached closer we could see the white foam dashing up against the lofty cliffs and the old gum trees on the bold slopes. One could almost smell the *Eucalyptus*, or imagine that he did.

Range after range of mountains were visible following each other in the distance, some tipped with snow and others enveloped in clouds. There is an indefinable beauty about the sombre cliffs of Tasmania, not only to an Australian legitimately proud of all things Australian, but also to foreigners. The Norwegians on board declared the coast to be much similar to that of their own beloved Norway.

Along the coast we steamed, soon we passed S. W. Cape and later on the rugged Cape called Tasman's Head. As it was now getting dark, it was decided to anchor in the historical Adventure Bay and proceed up to Hobart

next day. It was here that that intrepid Dutch navigator, Abel Tasman, first anchored when he discovered the Island more than two centuries ago (24 Nov. 1642), and where his carpenter swam ashore to plant the Dutch flag.

The discovery of Tasmania and New Zealand was no chance adventure. It was the result of a steady policy. It was the outcome of the adventurous energy which, in the sixteenth and seventeenth centuries, created the Dutch Republic, gave to Holland her Colonial Empire; and—not content with her possession of the Eastern Archipelago—sent out her sailors to search for a new world in the unknown regions of the mysterious South. Tasman is but a type of the men who won for their country her once proud position of mistress of the seas.

Tasman's discoveries, great as they were from a geographical point of view, bore no fruit for more than a hundred years. His tracks were marked on the Charts, but as to the countries he discovered, his countrymen in the East Indies, whose sole object was trade, felt no temptation to explore the wild bush of Van Diemen's Land, or even to plant Colonies on the barren and inhospitable shores of Western Australia, peopled by naked savages. Only the Englishman, Dampier, in 1688, and again in 1699, visited the western coast, and was glad to leave what he described as the most miserable country on earth. Had Tasman but discovered the way through Torres Strait, it is possible that New South Wales might have been colonised by the Dutch.

It was reserved, however, for an English navigator, more than a century after Tasman's voyage, to make the practical discovery of Australia as a land for European colonisation. When Captain Cook in his first famous voyage in the

Endeavour, on Sunday, 29 April, 1770, cast anchor in Botany Bay, the Australian Continent was first laid open to European enterprise. Eighteen years later Sydney was founded by Englishmen.

A hundred years' growth has now made Australia well-nigh a nation ; but as yet it is a nation in the gristle only. When the petty jealousies of the Colonies are laid aside, and now that the several States are united in one great Federation, we may feel a perfect confidence that, amongst the children of the old English mother, not the least important will be those dwelling in the island Continent circumnavigated by Tasman two hundred and fifty years ago, who to-day claim the title of Citizens of the Commonwealth of Australia.

As soon as the anchor had been let go, some of us launched a boat and rowed ashore to search for some habitation where we might procure fresh vegetables, etc. There was a spot marked *Cooktown* on the chart of the locality, so, naturally, we thought there would be no difficulty in getting what we required. We were, however, disappointed. After strolling for some time in the direction of the supposed *Cooktown*, we suddenly came upon a small hut—a typical Tasmanian bush hut. A dog barked feebly as we approached, and an old cow that had been feeding contentedly among the flower plots of a very primitive garden scampered away hurriedly into the scrub. Possibly the poor old thing had never before seen so many human beings—there were six of us. No lights were shown anywhere. Evidently, the inhabitants had retired to rest, although it was scarcely nine o'clock. I walked up to the door and rapped gently. No response. I rapped again more severely. Silence. The third time I rattled the door with considerable vigour—silence for a few seconds, then from

the depths of the hut a tremulous voice called forth : "Who's there?" Silence on our part. Then came the voice again, "Who's there?"

It was a high-pitched and decidedly feminine voice, and its owner was evidently much frightened. I was at my wit's end to know what to reply, for we were perfect strangers to the place, and we had not reckoned upon encountering a woman.

The stifled laughter of my companions in the background also prevented me from responding readily. While trying to think of some rational reply, we were suddenly startled by hearing the voice shriek out through a crack in the panel of the door, "Who's there? Who's th-th-there?"

"Don't be afraid," I said, as gently as possible, in order to reassure her. "We won't harm you. We belong to a ship that has just put into this bay, and we are much in want of fresh provisions, and we thought we could probably get them here."

A few moments' hesitation, then the bolt was drawn back; the door opened to the extent of a few inches, and a face appeared at the opening. It was a very young and a very white face, and started back at seeing so many dark figures standing outside. After a few kind words, its owner recovered from her fright and opened the door wider.

She was quite a young girl, not more than eighteen or twenty, and rather pretty. She had evidently dressed in great haste, for she was clad in her petticoat and had a plaid shawl wrapped around her shoulders. Poor girl! She appeared to be very frightened.

"You are not afraid now," I said, after a few moments' explanation.

"Noo," she answered, with that slow nasal Australian bush accent. "But you did gi' me a bit of a turn, yer know," and she smiled feebly. "Ye' see, me 'usband's aweey at present, and I'm all be meself, but for Jim-mee 'ere," and she pointed to a little urchin who was clinging to her petticoat. "I was in bed, ye' see, when the knockin' come, and I couldn't make out for the world who it was."

"We are exceedingly sorry to have frightened you so. Of course we did not know you were alone. There is a place called *Cooktown* somewhere about here; can you tell us where it is?"

"O, this is *Cooktown*," she quietly answered.

"Eh! *This* Cooktown? Why, there is only this hut here! Are there any more *towns* near here?"

"Well—the're the Saw-Mills on t'other side of the Bay, but it's four mile from 'ere."

"O!—Do you think you can let us have some vegetables and eggs, or some fowls?"

"Well, we 'aven't got any vegetables, nor eggs and fowls at present. Ye' see, we're goin' aweey from 'ere, and me 'usband sold all the fowls last week."

"That's rather unfortunate for us"—pause—"Are there any opossums about here? Grey or black ones?"

"Well, I don't think so—is there, Jimmee?" appealing to Jimmy.

"Noo," replied Jimmy. "But ther' some ringtails* up along the shore in the she-oak trees."

"O yees, ther' some ringtails," said the girl enthusiastically, "Jimmee ofeen gets 'em with 'is little doog."

"Ah, well! We'll go and try to get some ringtails; we

* A small species of opossum.

have a gun. Good-night, and thanks very much. Sorry to have put you to so much trouble," and away we sauntered.

We roamed around for some hours, looking up into the trees for ringtails, stumbling over logs and falling into water holes, until we got pretty sick of the sport, and returned to our ship. Needless to say without having seen a solitary tail.

On the following day we reached Hobart, the capital of Tasmania, where piles of letters and newspapers awaited us.

The *Southern Cross* remained a little more than a fortnight in Hobart before proceeding on her voyage towards the South Pole.

During all that time the members of the Expedition were fêted by the residents. The remembrance of the dinners garden parties, drives into the beautiful interior of the Island, shooting and fishing excursions, and the handsome and charming Tasmanian ladies, was something to carry away with us into that ghostly frozen world for which we were bound.

A grand reception under the auspices of the Royal Society of Tasmania was accorded us in the Town Hall, and was brilliantly successful. The Hall was filled by about 800 citizens, representing all classes of Society, and justified the comment made by His Excellency the Governor, that the gathering was the largest he had ever presided over in Tasmania.

Most of those present were in evening dress, and the Hall presented a brilliant appearance. Numerous addresses of welcome from various scientific bodies were read. Speeches were made by His Excellency Lord Gormanston, by the

Bishop of Tasmania (Dr. Montgomery), the Treasurer Sir Philip Fysh, the Mayor of Hobart, and the Speaker of the House of Assembly (Hon. N. J. Brown), and were responded to by the leader of the Expedition, Mr. C. E. Borchgrevink.

Words fail to express the many kindnesses we received from the people of Hobart during our stay there. They were most hospitable, as are all Australians. The whole town appeared to us to have but one occupation—entertaining the members of the Expedition.

Our thanks are especially due to Mr. Alexander Morton, the Curator of the Hobart Museum and Secretary of the Royal Society of Tasmania, who did so much to make our sojourn such a very pleasant one.

Tasmania has quite a European look. It is like a bit of Normandy or Devonshire, with its woods and hills, its flowers, its hedges of wild rose and hawthorn. Nothing is grandiose, but all is pretty and picturesque. It is an English landscape in the most perfect climate imaginable. The population of Tasmania is about 180,000, and the country is, in the main, prosperous, and suffers less from the "unemployed" difficulty than its larger neighbours. As a rule, a provident, sober man can always obtain work at a remunerative rate, and the wealth of the country is, on the whole, evenly distributed.

Scientifically, Tasmania has progressed in an encouraging manner. Sir John Franklin—the great Arctic Explorer—who became Governor in 1837, exhibited an amount of enthusiasm in scientific and educational pursuits which stimulated very considerably the intellectual life of the settlers. It was during his tenure of office that the French warships *Zelé* and *Astrolabe* called at Hobart with news of their discoveries in the Antarctic Regions, and the English Expedition

to the same regions, under Sir James Ross and Capt. Crozier, started from and returned to Hobart in the ships *Erebus* and *Terror*. Sir Joseph Hooker, who accompanied the Expedition as botanist, used the opportunity to collect specimens of Tasmanian flora, and a large part of his descriptive account of the botany of the Expedition is devoted to Tasmania. Mr. John Gould, collecting materials for his work "Birds of Australia," also visited Tasmania, and included descriptions of Tasmanian species in his valuable works. Mr. R. M. Johnston, F.L.S., is the author of several important books relating to Tasmania, chief among them being his "Systematic Geology of Tasmania."

The blacks of Tasmania have long been extinct. The last of the race—a woman called Truganina—died in 1876.

The blacks that inhabited Tasmania may be taken as representing the primitive state of the European men of the older Stone Age (or Paleolithic period) when men hunted the mammoth, reindeer, wild horse, and the primeval bull, for their domestic utensils were stone axes and knives of the very rudest construction. Although they were acquainted with the art of producing fire, they possessed no bows and arrows, nor did they use the shields, boomerangs, and throwing sticks of their Australian neighbours. In appearance, they were small, averaging about five feet, colour of the skin dark brown, and the hair finely curled or frizzed. It is said that many of them were really handsome savages. They lived like beasts of the forest, in roving parties, without any arts of any kind, sleeping in summer like dogs under the hollow sides of trees. They had little of that fierce or wild appearance common to people in their situation, but, on the contrary, seemed mild and cheerful, without reserve or jealousy

A TYPE OF THE LOST TASMANIAN RACE.

of strangers. Their languages were soft and musical, and quite unlike those of the Australian continent.

Just prior to the departure of the ship from Hobart, a tribute was paid by the members of the Expedition to the memory of Sir John Franklin, by placing a wreath on the statue in Franklin Square. The wreath was composed of laurel, ivy leaves, and white lily blossoms. With the wreath was placed a card bearing the following inscription :—"A tribute to the memory of Sir John Franklin, Knight, R.N., K.C.B., Lieut.-Governor of Tasmania, 1837-43, from the Commander and Members of the British Antarctic Expedition, 1898," and then followed those beautiful lines of Tennyson's on Franklin's Cenotaph in Westminster Abbey :—

> "Not here ! the white north has thy bones :
> And thou, heroic sailor soul,
> Art passing on thine happier voyage now
> Towards no earthly pole."

At last came the inevitable day of departure. On Sunday, December 17, we left Hobart amidst great enthusiasm. The quay was thronged with spectators assembled to bid us farewell.

Previously to the departure, the Dean of Hobart conducted an impressive service on board, which brought home to our minds the dangers attendant on the enterprise.

On December 19th at 4 p.m. we weighed anchor and steamed out of Adventure Bay, where we had been compelled to seek shelter from a gale, and stood towards the south. At 6 o'clock we were off Tasman's Head, the last of civilised land we were destined to see for many long months. The sun was just setting behind the bold headland and lit up the dark rocks jutting out at its extremity with a golden efful-

gence. We leaned over the bulwarks and feasted our eyes upon the scene. Slowly—very slowly it faded from view. At last the land disappeared altogether, and we were again on the wild, open sea.

We had now fairly started for the cold land of the south, but what to expect in that land of mystery and desolation it were rash to conjecture.

GOOD-BYE TO CIVILISATION.

From a photograph] [*by* BEATTIE, Hobart.

CHAPTER II.

"And now there came both mist and snow,
And it grew wondrous cold:
And ice, mast-high, came floating by,
As green as emerald."

—COLERIDGE.

IN all Nature's realm there are few sights more impressive than a vast field of magnificent glittering ice-floes on a beautifully calm morning with the deep blue Antarctic sky overhead. Lonesome, and unspeakably desolate it is, but with a character and a fascination all its own.

It was on the last day of the year 1898 that the *Southern Cross* entered the formidable Antarctic ice-pack, which, like a mighty spell, surrounds the land we wished to attain, as if to guard the treasures locked up within its bosom.

It was a magical sight, those vast shining ice-fields, and one never to be effaced from memory.

We entered the pack in Latitude 61° 56′ South, and Longitude 158° 55′ East, quite suddenly, and with little premonition of our approach to a large body of ice; usually, icebergs are met with long before the main pack is seen, but we had passed none. Our only warning was a dense mist or vapour line on the horizon, visible some hours previously, and a slight fall in the temperature of the sea.

The first ice sighted was a small piece a few feet in

diameter, the temperature of the air at the time being 34°.5 Fahr. and that of the sea exactly the same. The colour of the sea now rapidly changed to a dull dirty green, due, no doubt, to the presence of a large quantity of fresh water from the melting of the ice. An hour afterwards, thousands of small blocks of ice hove in sight; half an hour later the ship was surrounded by them, and in calm water. It had all happened so suddenly, that we could scarcely realize we were really beset in the ice-pack about which we had read and heard so much! Within an hour of sighting the first piece, we were in the thick of it. It was truly a marvellous sight to one who had spent nearly the whole of his life in a semi-tropical climate, and mere words can in no way adequately express those first sensations.

The blocks of ice were of the most fantastic shapes imaginable, for all were in an advanced state of melting; grotesque palaces, pinnacles, towers, bridges and arches of ice, all formed, in their architectural outlines and groupings, the semblance of a great city. The colouring in the cracks and cavities was magnificent; a light green tint of most exquisite delicacy, contrasted with the alabaster whiteness of the floe, produced a wonderful and superb effect. In some places the ice was stained by yellow colouring matter. Captain Ross noticed it, and took some of the stained matter home with him. The specimen was submitted to the eminent naturalist, Ehrenberg, who detected, with the microscope, that this colouring matter consisted of countless myriads of an entirely new and minute form of organic life which, he observes, arrived in Berlin in 1844, in a living state, and of which almost all the separate

AN ICEBERG.

atoms were independent siliceous shelled creatures. Subsequently, Doctor Klövstad, our medical officer, examined some of this yellow colouring matter collected from an ice-floe which was almost decomposed by it. Seen under the microscope, it was a revelation, consisting, as it did, of a mass of diatomacæ. The organisms formed chains of ellipses resting upon each other at the extremities, and of which the major axes were considerably greater than the minor. In the centre of the ellipse was the yellow colouring matter or shell, having a nucleus. The colour gradually darkened from the outer edge of the coloured matter to the edge of the nucleus.

The first large iceberg put in an appearance during the afternoon. It was about 70 feet in height and tabular in form, with great yawning caves in its sides, which glistened with iridescent hues, and into which the seas roared ominously.

For every cubic foot of ice above water, there are seven cubic feet beneath. When a large berg is seen, it is therefore quite impossible to realize its full size. Even those who have studied icebergs at close quarters, find it impossible to conceive their colossal bulk. The average Antarctic iceberg is about 120 feet in height above water, and some are miles in length, one having actually been recorded 50 miles long; so that the bulk of such bergs, if measured, would run into billions of tons.

Later on we will refer to these icebergs, and to their formation and characteristics. We were no sooner well in the pack than the beautiful white ice-petrel (*Pagodroma nivea*) appeared. It is one of the most graceful birds on the face of the globe, and is never to be found far from

the southern ice-fields. It resembles somewhat a pure white dove, and is of about the same size, with jet black feet and bill. It is a silent companion, rarely uttering a cry. Soon after the long polar night, when we were badly in want of fresh food, we endeavoured to eat some of these beautiful creatures. Alas! although so fair to look upon, a closer acquaintance proved altogether undesirable, for the flesh was tough, dark, and utterly flavourless.

The Black-backed and Sooty Albatross left us at the ice edge, but the Cape Pigeon still followed in our wake.

The year 1899 will ever remain an eventful one in our lives. We saw the "Old Year out and the New Year in" in the orthodox fashion, with ringing of bells and blowing of foghorns, tooting of steam whistles and clattering of tin cans, howling of dogs, and salutes from our guns, a pandemonium truly, and one which in that silent world of ice sounded weird in the extreme. At one o'clock we witnessed the splendid spectacle of the rising of the sun over those white flats. Glorious it was beyond all expectation. At first there was but a pale pink colour in the eastern sky; but this slowly deepened and grew richer and richer. At last the gorgeous purple edge of the sun swept up from beneath the horizon. An intense stillness prevailed everywhere. The impressiveness and loveliness of the scene is indescribable. In a short time the whole of the majestic orb was visible, and a broad stream of crimson light shot across the glittering floes, changing their pure whiteness to a blood-red hue. Owing to the great refraction in those high latitudes, flames appeared to dart across the horizon, and resembled a mighty conflagration. Higher and higher he rose, changing

the colour from dark red to every variety of shade ; paler and paler it grew, until at last the grandeur of the scene had passed away.

Next morning I was out on deck at five o'clock and found Mr. Hanson and two sailors hunting a seal. Hanson leapt on the ice-floe upon which the seal was sleeping, and endeavoured to shoot it, but the cartridges were damp and would not explode. He had, therefore, to resort to a small pick, which he drove into the animal's head. The seal, aroused from a deep and peaceful slumber, naturally resented such inconsiderate treatment and became angry, so he straightway made for his assailant. The pick was still in its head and at the end of the pick the Zoologist, who clung tenaciously to it. Then the seal made some ugly attempts at his legs, but he skipped out of the way and got upon its back. This place of refuge, however, was extremely unstable, for he lost his balance and slipped down on to the floe. Then the furious beast, maddened with pain, went for him in deadly earnest, and a grim fight ensued, in which the sailors were powerless to intervene. At last, after some narrow escapes from the powerful jaws, it was despatched. The species was the fine silvery-white seal (*Lobodon carcinophaga*).

Soon afterwards a large sea-leopard (*Stenorhynchus leptonyx)* was seen and easily shot from the ship. The dogs enjoyed a royal banquet that day, such as they had not had since leaving Tasmania. The ship having been temporarily stopped in her progress southwards by the openings in the ice closing up, these dogs were let loose upon the floes ; how they enjoyed their liberty. They were in their native element, and scampered madly over the floes and rolled about in the snow.

For the first time the English members of the Expedition now tried running with the Norwegian *ski*, those long snow-shoes or runners used so successfully in recent years on Arctic Expeditions. They were not so difficult to manage as we had anticipated, and we got on fairly well, notwithstanding that our legs were a trifle at variance with each other; for, whilst the right leg would fain go east, the left struggled to go west, with the result that they both went heavenwards. Crossing chasms in the ice-floes was a most difficult task, and in some instances rather dangerous. The Commander of the Expedition had rather a narrow escape from drowning in one of these chasms. Whilst endeavouring to cross an opening on *ski*, he missed the opposite edge of the floe and fell into the sea. The long *ski*, buckled tightly to his boots, prevented his getting his feet under water, so his head went instead, while the *ski* waved violently in the air by way of distress. Fortunately Mr. Fougner was close behind, and extracted him from a precarious and somewhat inelegant position.

During the next few days we steamed from hole to hole, but really made very little progress. As we advanced farther in the pack it acquired a very unpleasant aspect, becoming heavier and closer every hour. Frequently we had to stop, completely blocked by the ice, no open water being visible in any direction. If we had entered the ice-pack farther east we should possibly not have been blocked so soon. Would that we had! for we might have been able to place our winter quarters farther south than we did, where better conditions would have been afforded for gaining the interior of the Antarctic land. For forty-three long days we were imprisoned in that dreadful ice-pack; the longest period a ship has ever taken to get *through* it. On first entering it ice

was visible to the horizon in the south and west, whilst in the east and south-east there was open water. Our experiences and those of other explorers tend to prove that the ice-pack on the Australian side of the Antarctic circle is not nearly so dense in an easterly as it is in a westerly direction. Ships that have entered the pack in about 170° East Longitude have penetrated it in a few days, whilst those entering in between 150° and 165° East have taken more than a month. There are numerous instances in the history of Antarctic navigation which go to prove this. A strong cold surface current appears to set out from Ross Sea in a north-westerly direction driving the ice up northwards, between Kerguelen Island and Australia. At Cape Adare huge bergs were often observed during perfectly calm weather travelling at about four knots an hour towards the north-west. The prevailing south-east winds are also a factor in driving the ice in that direction.

The lower latitudes reached by the pack-ice naturally fall short of the extreme, and to some extent even of the mean, limit of icebergs; nevertheless, the sea-ice reaches fairly low latitudes, and, like the icebergs, mostly so in the Atlantic, where it has been known to arrive at and beyond 48° South On the other hand icebergs have frequently been seen as far north as 40° S. Indeed, on the 30th of April, 1894, a piece of ice was seen in Latitude 26° 30′ S. and Longitude 25° 40′ W.; the remnant, no doubt, of a huge iceberg. The sea-ice which constitutes the bulk of the pack is first formed by the freezing of the sea in the winter along the shores of the Antarctic lands. This freezes to an average depth of from four to five feet, and extends out into the ocean for perhaps fifty miles, until the formation of an uninterrupted sheet of ice is prevented by its perpetual violent agitation. This ice begins to break up

early in November and move northwards, and by the middle of January the coasts are almost free. As this body of sea-ice moves towards the north it is frequently driven back by northerly winds. Thus, in consequence of the circumstance that land lies to the south, which excludes the possibility of more sea-ice following in support, an open sea, comparatively free from ice, is met with in the Antarctic regions almost regularly when the principal zone of pack-ice has been pierced. Serious danger from ice-pressure in the open pack is comparatively slight. Once on the 24th of January a rather severe pressure set in, during a gale from the E.S.E., when the *Southern Cross* was fast wedged in the ice. On the port side the blocks piled up to a height of nearly fifteen feet, and on that side the ship was lifted four feet out of the water, but at no time were we anxious for her safety. The pack, very susceptible to a gale, drives before it, and so there is really no danger, for there is no resisting force. But woe betide a ship that ventures to winter near the coast, unless it be in a well-sheltered inlet, for when a pressure sets in there, it piles the huge blocks of ice up on the shore to from twenty to sixty feet, and a ship would surely be crushed, no matter how strongly she may be built. A real source of danger, however, is a gale or very heavy swell on the edge of the pack, when huge masses of ice crash into the sides of the ship with terrific force, causing the tall masts to quiver for some seconds after the shocks, or the mighty blocks grind in against the sides as they pass. That is the worst sensation. You do not mind the shocks received at the bows, for she is strong there, but that crunching sound alongside is disturbing, however strong your nerves may be.

In the ice-pack, the surface temperature remains uniformly

THE "SOUTHERN CROSS" IN THE ICE-PACK ON NEW YEAR'S DAY.

below 32° Fahr., but above 28° Fahr. The mean surface temperature for January was 29°.64 Fahr. and that of the air, 22°.24; the mean temperature for the second week being the highest in both cases. On January 28th a temperature of + 33°.1 Fahr. was observed at a depth of 1,000 metres in Latitude 66° 35′ and Long. 165° 54′. The ocean depths are

TAKING DEEP-SEA TEMPERATURES.

here very great, for although we were then only about sixty miles from land we did not get bottom.

Numbers of seals and species of birds were procured by Mr. Hanson for collection purposes. It seems truly a horrible intrusion slaughtering those harmless seals sleeping upon the ice under the peaceful silence of the blue Antarctic sky and dyeing the dazzling immaculate white of the ice-floe

with glaring crimson pools of blood. All the seals, with the exception of one, were the white seals of the species *Lobodon carcinophaga*. The exception was at first thought, by some, to be an entirely new species, but on our return to England it was proved to be the Ross seal (*Omatophoca Rossii*), as the zoologist, Mr. Hanson, had at first asserted. The specimen was nearly seven feet in length, was of a dark hue and had a short round head. It had six teeth in the upper and two in the lower jaw, and under the neck hung a large fleshy protuberance. It appears to be extremely scarce.

The little Antarctic Penguin (*Pygoscelis Adeliæ*) was very common, but we saw the large Emperor (*Aptenodytes Forsteri*) rarely, and nearly always solitary. The quaint ways of these birds were frequently a source of great amusement. Once a party headed by Lieut. Colbeck set out across the ice to hunt some small penguins. At about the same time the penguins set out for the party in order to investigate the strange animals coming towards them ; for their curiosity is astonishing. Along the floes they came, waddling from side to side and raising and lowering their flippers in a most ludicrous fashion. At last they came right up to the men, walked around and surveyed them critically in a most comical manner. Alas ! they knew not what hidden fierceness existed in those beings they were so innocently examining.

Colbeck suddenly made a sweeping blow at a penguin with a fine rifle that he carried, missed it—a fortunate thing for the bird, but disastrous to the gun, for it struck a projecting piece of ice with such vigour as to smash it completely. On another occasion, when three Emperor penguins suddenly leapt up on a floe quite close to the ship, an embryo

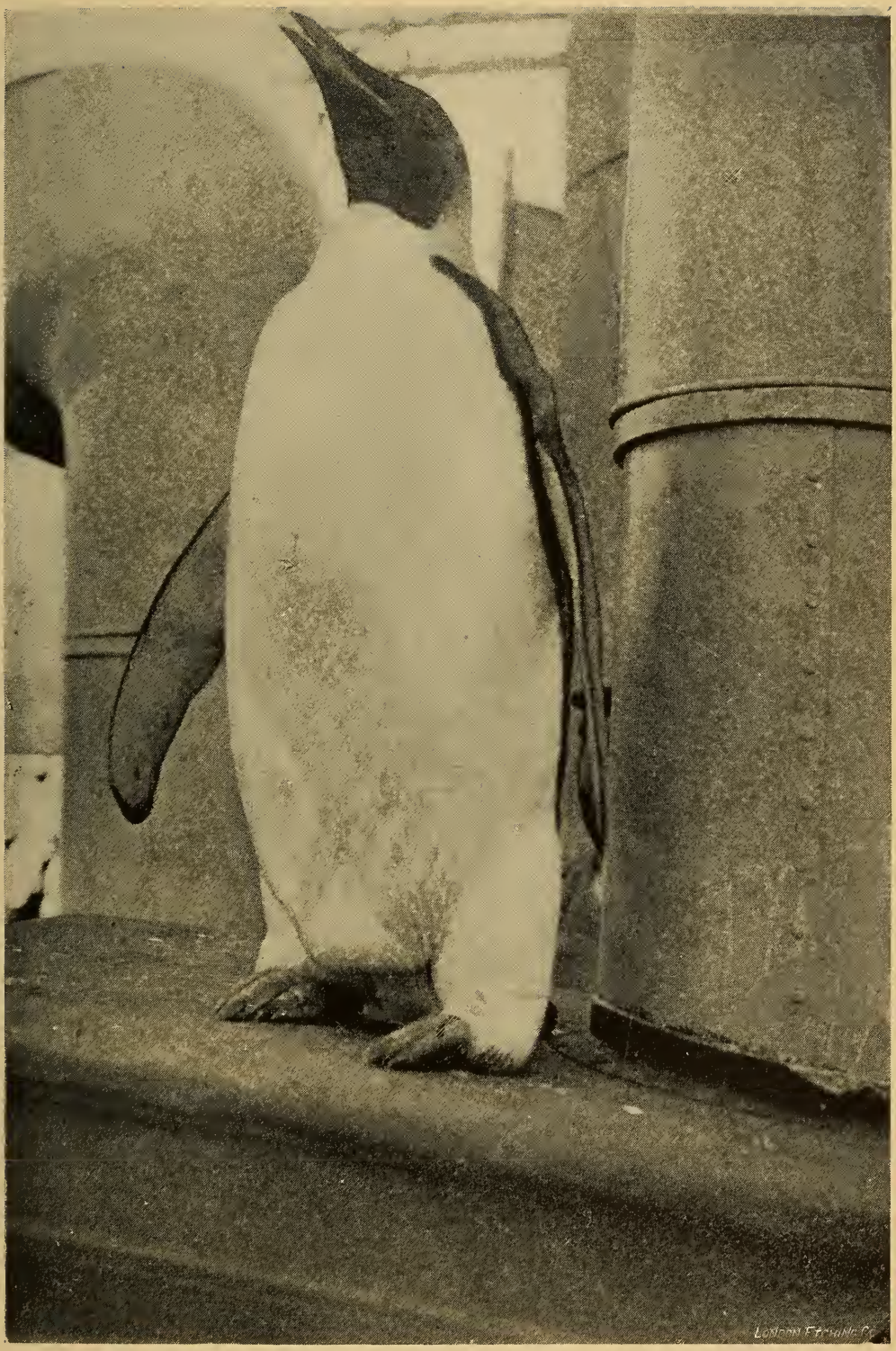
taxidermist who had just completed stuffing a large penguin until it resembled a huge champagne bottle with innumerable irregularities in its construction, conceived the brilliant idea of taking the stuffed bird down upon the floe and endeavouring to entice the others to his arms by its aid. So down he went upon the ice, bearing his specimen with him, and placed

THE ROSS SEAL.

it in a conspicuous position. I think the poor Emperors had never before seen such a lamentable sight; what feelings were theirs! Reverently they gazed at it from a distance; then an expression of infinite sadness, of tender pity and compassion passed over their features; slowly, and in deep awe, they waddled to the water's edge with hearts too full for expression. How strange and profound is the work of man, they must have thought, and disappeared into the depths of

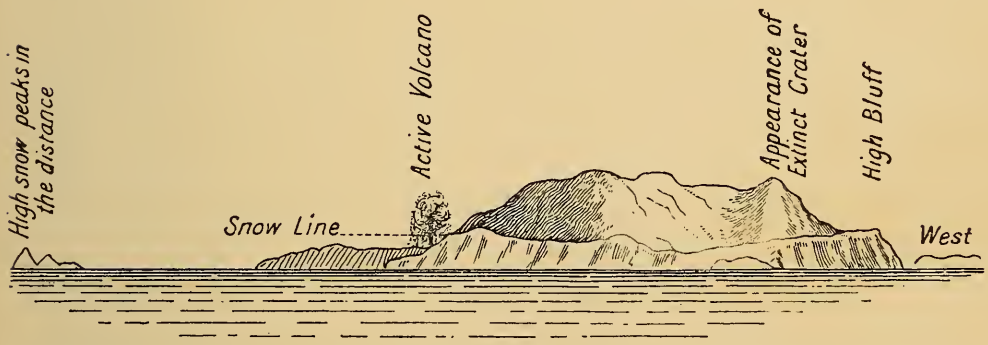
the ocean. Two of these birds were procured one day that weighed between 70 and 80 lbs. They were found on an ice-floe seeking shelter from the wind behind a hummock. One was moulting, and, from the stained appearance of the ice upon which he was resting, had been perched there some days. It took nearly twenty minutes to asphyxiate them with chloroform. On dissecting one, the contents of the stomach were examined and found to hold red crustaceous matter, small fish from two to three inches in length, some green matter like seaweed, and a few small rock fragments. Three of these fragments presented granitoid characters, and the fourth was a greenish-grey lava rock.

At noon on January 12th a faint grey light was sighted on the port bow. At one time it looked like a cloud, at another it had the appearance of land. Many were the conjectures. Finally it proved to be land, and very high land too. We had now a considerable amount of water around us. It appeared then as if we were clear of the main pack. The day was beautifully clear and not a breath of air stirred a ripple on the glassy patches of water. The land was at first taken by the captain to be some undiscovered island. I went up into the crow's nest to have a better look-out ; the captain was there in a great state of excitement, so convinced was he that he had discovered new land. Most of us, however, were extremely sceptical, and could not participate in his elation. It seemed improbable that such an able navigator as Sir James Ross, who actually went over the same ground, should have missed this discovery. When we perceived a dull volume of smoke rising from the east end of the land, which was undoubtedly the smoke of a volcano in eruption, we decided it was one of the Balleny Islands, upon which



THE EMPEROR PENGUIN.

Balleny had mentioned the presence of an active volcano. As we approached closer, the outline of the land became admirably clear and defined. Owing to the abundance of light reflected from the white glittering snow-clad surface few shadows were cast on any part. Observed through a large telescope, abundant detail could be made out. A vast mantle of snow descended to within 600 or 800 feet of the sea and there ended abruptly. On account of the rarity of the atmosphere, and the sharp contrast between the immaculate white



ONE OF THE BALLENY ISLANDS, LAT. (OF SHIP) 65° 3′ S., LONG. 161° 43′ E. CENTRE OF ISLAND BEARING S. 20° E. TRUE, DISTANT ABOUT 50 MILES.

of the snow and the jet black of the cliff, this snow-line was easily traced right along the land even with the naked eye. From the appearance of its edge, the snow-cap must have been some hundreds of feet thick. At the west extremity was a high truncated headland, and above this headland to the east was a peak some 10,000 feet high, with a large and apparently inactive crater at the summit. At the east end the land was comparatively low, and, from its blue appearance, at a greater distance from us. It was from this part that the dark volumes of smoke issued at intervals. Low down in the eastern horizon were snow-clad pinnacles, only

discernible by the aid of the telescope. Outwardly the land exhibited a naked, desolate appearance, a volcanic desert covered with ice and snow, and so surrounded with ice ejected from the glaciers and forced on to the shores by the north-west current, that it is difficult, if not impossible, to examine the coast very closely. One sight in bad weather of that sinister coast is enough to make a landsman dream for weeks of shipwrecks, perils and death. I can imagine no greater punishment than to be "left alone to live forgotten and die forlorn" on that desolate shore. We approached to within forty miles of the land, and then progress was completely stopped by huge blocks of ice which had evidently only quite recently rolled down from the lofty peaks. We moored to a floe and decided to wait until the ice opened up and so allow the ship to approach closer to the shore. Plans were made for landing next day, if possible, and it was intended to send a short sledge expedition into the interior to investigate the country. During the evening, Lieut. Colbeck and I endeavoured to take a set of magnetic observations on a very large ice-floe, but we had to abandon the attempt owing to its movement. The zoologist, Mr. Hanson, played havoc among the birds, getting some twenty specimens, whilst the Commander did some kayaking between the ice-floes.

The sunset that evening was a wondrous sight; sunset and sunrise now mingled into one another so closely that one was scarcely distinguishable from the other—for we were almost within the area where the midnight sun becomes visible. The sumptuous colouring of the sky beggars description; the water was a mass of quivering and shifting colour as an array of clouds of the deepest purple hue swept gorgeously together beneath the sun, giving everything an unearthly

radiance, and the lofty peaks of perennial snow in the distance were lit up with a tender rose pink. The whole scene might well have been the fantastic dream of some imaginative painter. We sat up most of the night and early morning, watching the dazzling lustrous tints, and only retired after the sun had again reappeared above the horizon.

TAKING MAGNETIC OBSERVATIONS ON THE ICE.

The next day was a great transformation from the night before. During the morning, the barometer had fallen rapidly and towards noon it was blowing a gale of wind. A dense fog hung over the waters, completely blotting the land from sight. We were compelled to steer northwards to more open water, as it was dangerous to remain in the vicinity of such heavy ice. Thus all our nicely-arranged plans of the day before were frustrated. The force of the wind abated during

the afternoon, but the fog did not clear up, so, as there appeared to be little hope of making land in this kind of weather and there being no likelihood of it clearing, it was decided to abandon the idea and to proceed on our way to Cape Adare. On the 14th we made progress in a south-easterly direction, but on the 15th we were again hemmed in by the implacable glittering world of whiteness. Then followed many weary days with wind, sleet, snow and fog; days to lend one's heart and spirit to the influence of melancholy. Day after day we lay tightly wedged in heavy masses of land ice. The wind wailing piteously in the rigging, the dense mass of fog hanging like a pall over the ship, and the dull grinding sound of ice caused a feeling of infinite gloom. At such times the consciousness in what a remote corner of the world we were forced itself strongly and unpleasantly upon the mind. Towards the end of January our situation became grave. The ice extended in a great unbroken sheet around us with absolutely no sign of open water. We remained in almost exactly the same position each day, sometimes making a little progress south and east and then drifting back with the pack to the north west. In this crab fashion we made thirty miles southwards in a week. The Antarctic Circle was not crossed until the 27th. The sky was generally overcast, and it was a rare thing to catch a glimpse of the sun. The temperature of the air commenced to fall, the few small open pools of water became covered with newly formed ice, and the sea birds were flying northwards to more genial climes. With winter thus setting in our prospect was a cheerless one, and the chance of reaching Cape Adare appeared remote. The novelty of being surrounded by ice wore off, and open water would have

been hailed with greater joy than when we first sighted the ice. Towards the evening of the 28th January, the clouds lifted one by one, and the dense drooping mists slowly withdrew, disclosing to our eyes the rugged outline of a mountainous land to the south.

Eternal snow lay frozen white upon it and the cold, high

FAST IN THE ICE.

peaks seemed very far away. Nothing could look more inhospitable. At this time (10 p.m.) the east extremity was bearing S. 26° E. True, and the west extremity S. 45° W. True. Our Latitude at noon was 66° 46′ South, Longitude 165° 40′ East, and variation of compass 30° East, the land at that time being distant about forty miles.

The above observations were very carefully taken, and there

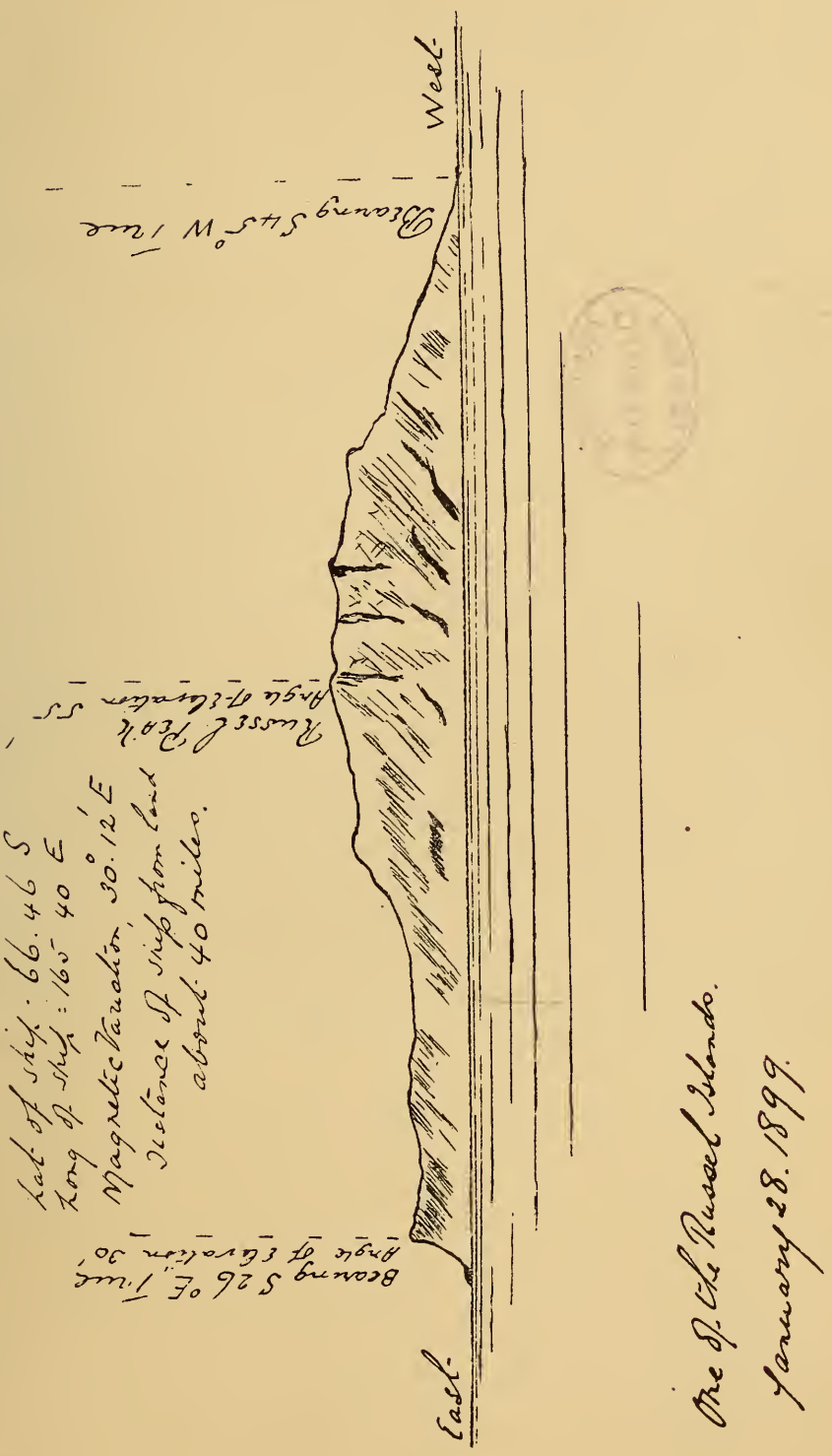
is very little doubt that that part of the coast line we saw extended for a distance of at least fifty miles.

It is almost certain that the land we sighted was one of the Russel Islands discovered by Sir James Ross in 1841. It has been suggested that the Balleny Islands and the islands seen by Ross near them were identical. We have proved that they are groups quite apart. The Balleny Islands were discovered on the 9th February, 1839, and consisted of three islands. The west cape of the middle island lay in Latitude 66° 44′ S. and Longitude 163° 11′ E.

Buckle Island was in active eruption in two places when Balleny saw it. To the east of it lies Sturge Island, which is cone shaped, whilst Young Island is the largest and highest of the group.

Ross's discovery lies more to the south-east. The position of Russel Peak, according to Ross, was Latitude 67° 28′ S. and Longitude 165° 30′ E., with which our observations agree. Ross has charted Russel Peak as an island without any other indication of it being such. He saw what he thought to be three islands, viz., Russel Peak, Frances Island, and Smyth Island, but he was by no means sure, for on page 267 of the first volume of his work he speaks of the "appearance of two islands nearly joining," and again, "although I believe these islands to form a part of the group discovered by Balleny in February, 1839, yet it is not improbable they may prove to be the tops of the mountains of a more extensive land."

The following day being fine, the land was plainly visible. It was not more than forty miles from us and was covered with vast piles of snow which never melts and seems destined to last as long as the world holds together. At the east end


West
Bearing S 45° W True
Russel Peak
Angle of Elevation 55'
Lat of ship: 66° 46' S
Long of ship: 165° 40' E
Magnetic Variation, 30° 12' E
Distance of ship from land
about 40 miles.
Bearing S 26° E True
Angle of Elevation 30'
East
One of the Russel Islands.
January 28. 1899.

of the island a high cape fell perpendicularly into the sea The west end sloped up gradually from the water's edge to a lofty peak (Russel Peak) which, as far as could be estimated, was 10,000 feet high and, where not covered with snow, terminated in sharp and jagged ridges of a very dark colour. The whole range was of a serrated nature and the snow cap extended to the water's edge, whereas on the land we had sighted a few days back it did not.

The whole of the north side presented to our view was precipitous, and in some places cliffs between 500 and 1,000 feet high fell sheer into the sea ; it would have been vain to attempt a landing.

Magnificent and stupendous as are the effects of nature, here one sight of it is quite sufficient. The little apparent elevation, in those regions, of land really lofty is at first surprising. This is due to a cause not at first suspected, namely, that the whole side, from the summit to the base, is in full view, and there are no intervening objects to afford means of judging the distance.

The ice fields of the *Southern Cross* remaining still undisturbed, some of us went that night for a long *ski* run to a large iceberg about seven miles away. It was a long run, fourteen miles altogether, and a tiring one for those not used to Norwegian *ski.* On the home run I unfortunately broke the leather strap which held the *ski* to one of my feet, so I had practically to *ski* on one foot and drag the other, which method, over rough hummocky ice, was not at all comfortable. The berg we found to be eighty feet in height and half a mile in circumference. The top was dome-shaped and the sides were distinctly stratified, showing each successive fall of snow. Apparently, it had not long been

ejected from its native glacier. Mr. Fougner and the Doctor reached the top of the berg on their *ski* and slid down on them, which latter appeared to me a rather perilous feat. Another member endeavoured to do the same, but on reaching half way up he got into what is vulgarly known as a "funk," and for some time could neither ascend nor descend. He cut

A MIDNIGHT PHOTOGRAPH—RUSSEL ISLAND IN BACKGROUND.

a somewhat comical figure sprawling on his stomach with his arms and legs extended. The berg in a sudden fit of mischief commenced to rise and fall gaily with the swell, as if hesitating whether or not to turn over, which naturally did not tend to improve the situation. He at last managed to descend by taking off his *ski* and gingerly wriggling down on all fours, to the intense amusement of those present.

The night was exceedingly fine, being clear and cold. The ruddy sunset behind the lofty snow peaks of Russel Island was very beautiful, and later on the rising of the moon, seen for the first time since our entering the pack, lent additional beauty to the scene. The sun and the moon are really the only familiar objects in those cold Polar seas. The blending of colour underneath the moon was wondrously rich—a dark greenish tint near the horizon, then a deep mauve, and uppermost, near the moon's limb, a faint pink. We were *ski-ing* along towards the ship when suddenly a brilliant point of light was espied in the sky; the planet Jupiter, the god of gods. Soon afterwards we saw Venus and the brilliant stars, Sirius and Canopus; these were indeed ominous signs of winter. It was after midnight when we got back to our ship.

On February 6th the ice opened a little, and we made good progress to the north and north-east. It was now decided to gain the open water to the north and, if possible, enter the pack again farther east. In the morning we passed an ice-floe, upon which there was quite a small colony of penguins of the species *Pygoscelis Adeliæ;* some were moulting, and had made themselves small cavities in the ice where they stood, until, apparently, the period of moulting was over. In the afternoon we sighted an iceberg of unusual form, consisting of three tall columns of ice, one of which was about 130 feet. This special iceberg was a marvellous piece of Nature's architecture. The peaks or columns of ice resembled huge icicles reversed. In some parts there were great fissures of a deep emerald green; in other parts, pendant icicles sparkled gaily in the sunlight. It was here that we lost one of our best Greenland dogs, one reputed to have

formerly belonged to Astrup, the Norwegian explorer, who accompanied Lieutenant Peary in his great "White March" to the north coast of Greenland. He disappeared mysteriously during the night, whilst we were moored to the iceberg, and, although the ship's company spent nearly three hours the next morning looking for him, no trace could be found. His loss was regretted by all, for he was a great favourite.

Most on board believed that he had fallen in a water hole and was drowned. Personally, I could not accept this theory, as he was much too sensible to patronize water-holes. Possibly, he set out for Cape Adare on his own account or made northwards; being a dog of vast experience in expedition matters, and possessed of much sagacity, he doubtless did some powerful thinking, and at last deemed it advisable to break connections with us!

Later on in the day our progress was stopped by a thin strip of solid ice, and the ice-saw had to be brought into requisition. During the operations of sawing and ramming some dogs leapt overboard and ran away for miles across the pack; thus some valuable hours were lost in capturing them.

On the night of the 9th February, a great storm arose from the north and blew for about six hours, during which our little ship was knocked about considerably; the actual velocity of the wind was about sixty miles an hour. I went up on deck at two o'clock in the morning, and it was then a sight to be remembered. The force of the wind was driving the ship under bare poles through the loose ice at something like four knots an hour. Every few moments she would crash into a mass which made her tremble from stem to stern. It was impossible to see a few feet across

the deck on account of the furious squalls of snow and sleet that drove over the vessel, nor were we able to hear each other speak for the shrieking of the wind and the rending noise of the ice. We were entirely at the mercy of the storm, and it was a terrible sensation to feel yourself rushing through the darkness in that manner, with the possibility every moment of running on to an iceberg. Before noon the storm had passed, and we made strenuous efforts to reach some open water to the east, which was indicated by a strongly marked "water-sky" in that direction. Towards evening of the next day, we reached the open sea, being then in Latitude 65° 33′ S. and Longitude 165° 48′ E. There was a swell from the north, and the temperature of the sea rose from 29°.1 F. at the edge of the pack to 30°.8 F. We were now in very nearly the same position as we had been six weeks before, and during those six weeks we had burnt nearly 100 tons of coal, with little result. We now steered in a south-easterly direction with the intention of entering the pack again farther east. During the next two days (11th and 12th) we passed some thousands of icebergs, as many as ninety being counted from the bridge at one time. There was very little variety of form among them, all being very large and bounded by perpendicular cliffs on all sides; they were on an average 120 feet in height. Each one of them was a centre of condensation, for over each was a white vaporous cloud. Could an eye from aloft look down upon the scene, the upper side of the cloud stratum would present somewhat the appearance of an immense cauldron boiling and bubbling and intermixing in the upper air. These icebergs facilitate the formation of clouds and promote precipitation. There was a considerable fall in the specific

gravity of the sea, due to the presence of large quantities of fresh water at the surface, derived from the number of icebergs.

On February 14th, we again sighted the ice-pack and entered it at about 8 p.m. Our Latitude at the time was 69° 20′ S. and Longitude 173° 0′ E. How very different its appearance was now to that in which we had before been held. Although very heavy ice, it was loose and agreed exactly with that described by Ross, who, in 1841, at this spot, forced his ship through in five days.

Towards midnight, the ice became much scattered, and we were practically in clear water to the south, having been only six hours in the pack. What a contrast this was to our previous unsuccessful attempt of forty-three days.

SLEDGES ON DECK.

CHAPTER III.

"Amidst Immensity it towers sublime,
Winter's eternal palace, built by Time."
—J. MONTGOMERY.

WE were now in the open sea to the south, for not a particle of ice was visible in any direction. Large flocks of brown-backed petrels were seen, and numbers of whales of the finner type. A sharp look-out was kept for land, and at 7 p.m. on the 15th of February it was sighted; but it was only a glimpse we caught of it through the dense canopy of clouds. Since noon the wind had increased steadily in force, until towards evening it was blowing a furious gale from the south-east and was accompanied by clouds of drifting snow. All that night and the following day the storm raged with full fury and the ship laboured heavily in the heavy seas. She lay to under half topsails, plunging fiercely into the seas and sometimes burying her whole bows beneath the waves, whilst ever and anon mighty green billows would pour over our decks and rush down into the cabins below. Our horizon was narrowly limited by the sheets of spray borne by the wind and the drifting snow, so we could see no land although we were not far from it.

The storm gradually abated towards the afternoon of the 17th, and we were able to stand in once more for the coast.

The weather continued to improve and the dense mist cleared a little. At two o'clock in the afternoon land was again sighted distant some twenty-five miles, and we headed for a dark and high mass of rock which was evidently Cape Adare. It was a Cape of a very dark basaltic appearance, with scarcely any snow laying upon it, thus forming a strong

CAPE ADARE.

contrast to the rest of the snow-covered coast. This lack of snow is principally due to the very exposed position of the Cape to the south-east winds, and, perhaps, also to the steep and smooth nature of its sides, which afford no hold for any snowfall. As we approached the coast it changed continually in aspect. Sometimes dense clouds of mist would envelop it; at other times the clouds would roll up like a great curtain, disclosing to our eyes a long chain of snow-clad mountains, the peaks of which tapered up one above the other like the

tiers of an amphitheatre or those of the Great Pyramid of Cheops; but it was only a momentary vision, quickly disappearing, then all was again sombre, nothing but the heaving mass of waters, the whistle of the wind in the cordage, and the blinding snow across our decks.

Although we were certainly twenty miles distant from the land, the intervening space seemed infinitely less; in those high latitudes the eye is constantly liable to be deceived in the estimate it forms of distances. Apart from the contrast of light and shade, the great height of the mountain ranges and their bareness (they being destitute of any trees, etc., whereby to afford a point of comparison) augment this singular deception.

The wind decreased in fury as we got under the lee of the shore, but the whole heavens were still overcast with a dark mantle of tempestuous clouds, which now and then enshrouded the land in its folds, hiding it entirely from our view. The Bay (Robertson Bay) was clear of ice excepting for a huge stranded and weather beaten iceberg in its centre, into the cavities of which the seas ever and anon rushed with a great roar. As we drew closer, the coast assumed a most formidable aspect. The most striking features were the stillness and deadness and impassibility of the new world. Nothing around but ice and rock and water. No token of vitality anywhere; nothing to be seen on the steep sides of the excoriated hills. Igneous rocks and eternal ice constituted the landscape. Here and there enormous glaciers fell into the sea, the extremities of some many miles in width. Afterwards, when the mist had cleared away, we counted about a dozen of them around the Bay, rising out of the waters like great crystal walls. Approaching this

sinister coast for the first time, on such a boisterous, cold and gloomy day, our decks covered with drift snow and frozen sea water, the rigging encased in ice, the heavens as black as death, was like approaching some unknown land of punishment, and struck into our hearts a feeling preciously akin to fear when calling to mind that there, on that terrible shore, we were to live isolated from all the world for many long months to come. It was a scene, terrible in its austerity, that can only be witnessed at that extremity of the globe ; truly, a land of unsurpassed desolation.

The bay, into which we had entered, was about forty miles in width, and appeared to be well sheltered from the south-west, south-south-east, and east winds, but was exposed to those from the north-west. At its southern extremity, one recognised the great peak of Mount Sabine, rising up in weird majesty to some 12,000 feet. We were now close in under the shore and in smooth water. How delightful it was to be in calm water under the lee of the cold high peaks, after being so long involved in the din of the roaring elements. The sounding line was kept going, but there appeared to be deep water close in ; indeed, there is little danger of finding banks or outlying submerged rocks anywhere along the coast of South Victoria Land. The "Dunraven Rocks" indicated on Ross's Chart as laying off Cape Adare, and over which, Ross states, the seas were breaking when he observed them, apparently do not exist. For although a most careful search was made for them during the twelve months we were at Cape Adare, they were never seen. If they exist they could not have failed to betray their presence during boisterous weather. Could it have been a large rotten submerged mass of ice

that Ross mistook for rocks? With the exception of one place, where a pebbly bank could be seen, basaltic cliffs rose almost sheer out of the sea to an average height of about 500 feet.

The Commander now decided to effect a landing and requested Mr. Fougner and me to accompany him ashore in a small canvas boat. We got into the frail craft and rowed her ashore, but it took nearly a quarter of an hour to reach the land, for, although the distance from the ship appeared small, it was actually great. The place of landing was a shelving beach, formed of gravel and pebbles; slight surf was breaking upon it and the boat had to be handled carefully so as to avoid capsizing.

Thus, after many months, we had attained our destination, notwithstanding the numerous obstacles with which our path had been beset.

After having hoisted up our boat out of reach of the sea, we commenced an examination of the place. We had not walked many yards before we met the secluded and melancholy inhabitants of that South Polar land; these were the penguins scattered about it in groups of a hundred and more. They extended us but cold courtesy and gravely regarded us from a distance; but on our approaching closer they evinced more interest and commenced talking loquaciously together in their own particular vernacular. They had evidently discovered that there was something unusual about our appearance, and some were commissioned to investigate matters. These, with perfect *sang-froid*, slowly marched right up to our feet and ogled up at us in a most ludicrous fashion. Having finished this scrutiny, they returned to their fellows as sedately as they had come, and thenceforth took no more notice of us. What

THE LANDING-PLACE AT CAPE ADARE.

impressed us greatly was the general appearance of sadness prevailing amongst them; they seemed to be under the shadow of some great trouble. It is no small matter that will arouse them from their stolidity. There were many young birds among them; no doubt most of the older ones had already migrated northwards, it being late in the year for

THE SECLUDED AND MELANCHOLY INHABITANTS.

them. The effluvium from the guano was very powerful. The strong ammoniacal odour at first gave us a sensation of nausea, but we soon got used to it and never afterwards suffered any unpleasantness. There was, however, no large accumulation of guano of any commercial value, for in no place was it deeper than from three to four inches, and this only in very small patches of only a few feet in extent. The

powerful winds prevent any extensive formation by sweeping all accumulations into the sea.

The place upon which we had landed was a triangular shaped and undulating bank or platform of detritus, the centre of which was about twenty feet above the water level, and the whole area some 180 acres. It was formed of rounded boulders, pebbles, gravel, and, near the mountain side, angular masses of débris. How this bank first came to be formed is difficult to determine for one who is no geologist; possibly it is the result of glacier action of some kind or is simply a raised beach. Many stones, however, are blown down from the summit of the Cape by the furious winds which sweep over those regions all the year round. Rock and boulders are no doubt also transported by the snow accumulating on the slopes above and slowly sliding downwards push the loose stones down before it. The alternate expansion and contraction caused by seasonal and rapid daily changes in temperature is the principal cause in disintegrating the cliffs. The vicissitudes in temperature during the year, more especially during the winter, are at times extreme, and astonishing. We have witnessed, in the middle of winter, the temperature alter in a few hours from -35° Fahr. to $+25^{\circ}$ Fahr. Ice forming in the cavities of the rocks, at a few degrees below the freezing point, exerts an enormous disruptive force. The volcanic rocks being all porous, in the summer collect much moisture, when the temperature is above freezing point; when the temperature falls, they have their particles pushed asunder by the freezing of the interstitial water. The observed amount of destruction thus caused is enormous; large blocks of stone are split off and launched to the base of the declivities. Some measure of its magnitude in those regions may be seen in the heaps of

THE PEBBLY BANK AT CAPE ADARE.

angular rubbish at the foot of the crags and steep slopes all along the coast.

There are many places where soil might form if it were not for the action of the winds, which blow all the finer disintegrated particles into the sea. The winds, blowing with cyclonic force, are so strong that loose rocks on the face of the cliff are hurled down, and blocks of stone and loose gravel are swept away.

Gravel and pebbles were everywhere heaped up in mounds and ridges. In some places these ridges coalesced so as to enclose basin-shaped hollows which were filled with strong-smelling liquid matter, and which, in the winter, froze solid. Some of these hollows were more than 100 yards in diameter.

Bleached remains of thousands of penguins were scattered all over the platform, mostly young birds that had succumbed to the severity of the climate. Thousands of years hence, if the species should become extinct, those remains, frozen and buried among the débris, will be available as a proof of what once existed in these gelid regions now just habitable, then, perhaps, not at all. Stretched out on their backs along the beach were many seals enjoying their quiet, hitherto undisturbed, siesta. They were of the species *Leptonychotes Weddelli*, of which we had not met one in the ice-pack; these were of a dark colour with light spots. As we approached them they opened their beautiful and large intelligent eyes, gazed at us nonchalantly, snorted, blinked, and went to sleep again. Fear with these animals, as also with the penguins, is evidently an acquired, and not an hereditary habit. Numerous mummified carcases of these seals were observed lying about.

We also saw a few Giant Petrels *(Ossifraga gigantea)* and

a great number of skua-gulls (*Megalestris Maccormicki*). These latter seemed to resent our visit, for they repeatedly darted at our heads and made a noisy outcry.

Satisfied with our preliminary survey of the place, we returned on board. The ship was brought in close to the shore and anchor let go in about eleven fathoms of water. Then, after some champagne-drinking and speech-making, we went on shore again, for all wanted to feel the rocks beneath their feet and to climb up the cliffs and get a look round.

It was nearly midnight when Mr. Hugh Evans and I commenced the ascent of Cape Adare. The light was still fairly strong at that time, nor was the temperature at all low. By following a ridge of craggy rocks we found the climbing tolerably easy and reached the top in less than an hour. We were thus the first human beings to set foot on the summit of South Victoria Land, and we felt full compensation for our climb. On the way up, we saw a few penguins, and even at the top (950 feet by aneroid) there were traces of them.

The scene before us looked inexpressibly desolate. A more barren desert cannot be conceived, but one of immense interest from a geological point of view.

From the end of the Cape to the foot of the mountain-range beyond, a great waste of hollows and ridges lay before our eyes; ridges rising beyond ridges like ocean waves, whose tumult had been suddenly frozen into stone. Beds of snow and ice filled up some of these extensive hollows, which had been scooped out by glacier action.

Never before had I seen the evidences of volcanic and of glacier action laying side by side—the hobnobbing of extreme heat and extreme cold. Great fire-scathed masses of rock rose out of the *débris* formed by the glaciers that had

THE SUMMIT OF CAPE ADARE.

passed over the land. Vast convulsions must at one time have shaken the foundations of this land. But now silence and deep peace brooded over the scene that once had been so fearfully convulsed.

Innumerable large erratic boulders lay scattered about which had no doubt been transported to their present position by the ice sheets from places many miles away. One huge boulder, which rested on the outer edge of a great basin, scooped out of the volcanic rock, was of grey granite and about ten feet in girth; some other boulders were of a green formation resembling diorite. In the eroded beds and among the *débris* we found numerous pieces of quartz with bluish streaks running through them. I was especially struck by its resemblance to some auriferous quartz met with in Australia. We also picked up pieces of pink and red granite and a hard greyish stone of the consistency of flint.

I must refer here to a statement made after the return from the South Polar seas of the whaling ship *Antarctic* in 1895, to the effect that "the intercalation of lava and ice had been observed at Cape Adare, and that in one place the lava flow appeared quite fresh." This statement has been very widely accepted as authentic. Sir Archibald Geikie has referred to it in numerous geological papers, more especially in his address before the Antarctic Congress in 1898. Dr. Karl Fricker also makes mention of it in his work on the Antarctic regions. Unfortunately, the statement is *absolutely without the slightest foundation*, for there is no sign of the intercalation of lava and ice in the old eruptive formation at Cape Adare, nor anywhere else along the coasts of South Victoria Land, unless it be in the vicinity of Mount Erebus.

When we had set out the weather was fine, but later on

the sky became overcast, as dark ominous clouds rolled up from the north-east.

The prospect from where we were was extensive, but scarcely beautiful. Down at our feet lay the sea, almost free of ice-pack. Huge stranded icebergs, defying the power of the solar beams, were visible in various directions along the coast. Behind us lay the great Antarctic Land; snow peaks rising beyond one another until by distance they dwindled away to insignificancy. The silence and immobility of the scene was impressive; not the slightest animation or vitality anywhere. It was like a mental image of our globe in its primitive state—a spectacle of Chaos.

Around us ice and snow and the remnants of internal fires; above, a sinister sky; below, the sombre sea; and over all, the silence of the sepulchre!

We descended with a light wind from the east blowing on our backs and rolling down clouds of fine snow.

We regained our ship in the early hours of the morning, and heartily enjoyed the steaming hot coffee that the Steward had most thoughtfully provided for us.

The next day the landing of the equipment was commenced, a task of considerable difficulty and hardship, and one which proved of extreme peril to the ship. Some seventy-five sledge dogs were landed first, and they at once began a fearful slaughter among the poor harmless penguins. The cargo was discharged in small boats which were hauled along a stout hawser stretching from the ship to the shore, and the boxes, etc., carried through the surf by bearers knee-deep in the icy water. A site for the huts was selected, and their erection carried on with all possible speed; but, although all worked untiringly, it was not until the end of the month that

THE OLD FLAG ALOFT.

everything was landed. But for the checking gales, this could have been done in three or four days, instead of twelve.

On the 21st February a great blizzard came on, which nearly resulted in the loss of the ship. The storm arose very suddenly in the afternoon, giving the shore party no time to get on board. There were seven of us on shore; five members of the staff and the two Finns, who, luckily, had brought their Lapp-tent with them, but for the protection of which we should have perished that night. This tent, which was similar to that used by the nomad Lapp in Lapland, and which resembled somewhat an Indian wigwam, being open at the top, was soon pitched and stones piled up around to keep it secure. Then we all made ourselves as comfortable as circumstances permitted round a fire in the centre. Towards night the wind increased until it blew with appalling force, bringing along with it tons of drift-snow. A heavy sea beat upon the shore and commenced to wash away the cargo which had been landed, and we had to turn out and toil for hours in the blizzard to save it, during which operations we acquired our first experience of frost-bite. The ship could nowhere be seen for the darkness and drifting snow, and we had little hope of her being able to brave the storm; nor, in this event, had we much hope for ourselves, for we had practically no shelter, and scarcely a year's provisions. In the tent, we were compelled to extinguish the fire. Then it became piercing cold; the whole pack of dogs, however, scrambled into the tent, and by laying on top of us kept us from actually freezing. Watches were kept throughout the night. At midnight, when I was on watch with Lieut. Colbeck, the tent gave unmistakable signs of departing, of which fact my fellow watcher seemed blissfully unconscious.

I therefore suggested that we should go out and pile more stones around it, and lash it down with ropes, an idea with which he did not seem particularly struck, and rather callously opined that one only was necessary for the job. Alas! at such times the best of us are monsters of iniquity and egoism!

At last we went out, and as we fiercely pitched the stones on to the tent, the talent exhibited in launching invectives against it, and the wind, and the South Polar Regions generally, was, to say the least, unusual. "The English are a dumb people, they can do great things, but not describe them." So says Carlyle. There are, however, exceptions; for our descriptions at that time were fairly graphic.

The wind continued all next morning, and it was not until the afternoon that we caught sight of our ship through the drifting snow.

Late in the evening, the sea had sufficiently subsided to permit us getting on board, where we found that our companions had had a more terrible experience. Very early during the storm the cables had parted and the ship commenced to drive out to sea, towards certain destruction among the icebergs. The engines, however, by steaming full speed, proved sufficiently strong to keep her almost stationary with her head to the wind. Stones blew on to the deck from the mountain, and once, at a critical juncture, an attempt was made to cut away the mainmast, but this could not be done on account of the great danger to life it involved. The old ship looked as if she had had a bad time and she was completely covered in ice from the flying spray. On the 24th there was a repetition of the storm, but this time not quite so strong. Another anchor was lost, and before the engines could be started the ship drove ashore and bumped

heavily on the rocks. By steaming full speed ahead, she was got off, apparently none the worse. Still, it was an anxious few moments for all. A large canvas boat was here cut to pieces by getting entangled in the propeller. We steamed for shelter to the southern extremity of Robertson Bay and moored the ship with ropes to the edge of a glacier which afforded good shelter.

On the afternoon of the next day (February 27th) three members of the staff—Colbeck, Hanson and Fougner—went on shore for the purpose of climbing the great glacier, taking alpen-stocks, ropes, etc., with them. They started early in the afternoon and returned at midnight. The surface of the glacier they found to be more crevassed than it appeared to be from the sea, and the climb was a slow and laborious one. They, however, succeeded in attaining an altitude of 2,300 feet. At 1,600 feet, three distinct kinds of mosses were procured, which somewhat resembled the reindeer moss found in Finmarken and Lapland.

Near the bottom of the mountain, they lighted on a quartz outcrop, which had walls of slatey matter; this quartz was very similar to some auriferous quartz I have seen in Victoria. Indeed, there is a striking analogy between the geological formation of the coasts of South Victoria Land and that of the Australian continent.

CHAPTER IV.

"Alone, alone—all, all alone."

—COLERIDGE.

ON March 1st, 1899, the *Southern Cross* left us; she was to sail for New Zealand first, spend the winter in Australian waters and return to Cape Adare in the beginning of 1900. Just prior to her departure the ceremony of hoisting the Union Jack upon South Victoria Land was performed. It was a picturesque and impressive sight to see the men grouped around the flagpole on this little strip of land surrounded on nearly all sides by grim, high peaks of snow, and it was good to hear the cheer that broke the silence of that strange land as the old flag fluttered out in the breeze. During this ceremony, ice-pack had accumulated between the ship and the shore and prevented us for some hours from getting on board.

If the departure of the ship had been delayed another day, it is possible that she would have been blocked by this heavy ice-pack and been compelled to winter in Robertson Bay, where she would inevitably have been crushed by pressure. A swift current was sweeping the ice around the Bay at something like three knots an hour, thus making it impossible for a boat to row through it to the ship.

At 6 o'clock in the evening we succeeded in getting on

board to bid good-bye to our companions who were returning to civilisation. There was much handshaking and good wishes, and some of the men even desired to remain behind with us. Soon the anchor was weighed; the screw slowly threshed the icy waters, and the helm swung round until the staunch little ship headed northwards towards home. We went down to the water's edge and fired a parting volley from our rifles to which they responded with their guns; slowly she passed out, threading her way among the ice-blocks and gently rising and falling in the swell; anxiously we watched her.

Ole the Finn was quite overcome at the departure of his comrades, and followed her around the shore as far he could get; he was a great favourite with all on board. A more perfect night one could not desire. The Bay was almost full of pack-ice, which shone like silver in the bright moonlight.

Gradually the good ship became but a mere dark speck to our eyes, although we could still hear her whistle coming to us across the waters. At last she was gone and we were alone on that desolate Antarctic shore, with nearly 2,000 miles of turbulent ocean between us and the nearest inhabited land. At first this does not seem so terrible, but let the reader glance at the map of those regions and he will realize how completely isolated we were from all the world, and how absolutely dependent upon the return of the ship. Supposing she had been lost; then two or three years must necessarily have elapsed before a relief expedition could have been expected, during which time most of us would probably have perished. First to winter on the Antarctic Land, we were absolutely in the dark as to what was before us.

The land party consisted of ten men, three Britishers and seven foreigners, as follows:

Name.	Nationality.	Age.	Profession.
C. E. Borchgrevink, F.R.G.S..	Norwegian	36 years	Commanding Expedition.
L. C. Bernacchi, F.R.G.S.	Australian	24 ,,	Astronomer and Physicist.
Lieut. Colbeck, R.N.R.	English	28 ,,	Magnetic Observer and Cartographer.
H. Blackwall-Evans	,,	24 ,,	Assistant Zoologist.
Nicolai Hanson	Norwegian	29 ,,	Zoologist (deceased).
Herluf Klövstad, M.A., M.D..	,,	32 ,,	Medical Officer (deceased).
Anton Fougner	,,	30 ,,	Scientific Assistant.
Kolbein Ellifsen	,,	23 ,,	Assistant.
Ole Must	Finn	22 ,,	In charge of dogs.
Persen Savio	,,	22 ,,	,, ,,

TABLE OF HEIGHT, WEIGHT, AND CHEST MEASUREMENT.

			cm.	cm.
Borchgrevink	5 ft. $8\frac{3}{4}$ in.	166 lbs.	97.5	91.5
Bernacchi	5 ,, $6\frac{3}{8}$,,	152 ,,	97.5	92.0
Colbeck	5 ,, 7 ,,	153 ,,	97.5	87.0
Evans	5 ,, $11\frac{1}{8}$,,	185 ,,	104.5	100.0
Hanson	5 ,, 10 ,,	180 ,,	98.5	90.0
Klövstad	5 ,, $6\frac{5}{8}$,,	155 ,,	98.0	87.0
Fougner	5 ,, $4\frac{7}{8}$,,	148 ,,	95.0	88.5
Ellifsen	5 ,, $9\frac{1}{8}$,,	160 ,,	97.5	89.5
Must	5 ,, $3\frac{3}{8}$,,	130 ,,	not observed.	
Savio	5 ,, $5\frac{1}{8}$,,	144 ,,	93	83

Averages.

English Element	5 ft. $8\frac{1}{6}$ in.	163.3 lbs.	99.20 cm. expanded.	
Norwegian Element	5 ,, $8\frac{1}{16}$,,	162.5 ,,	97.25 ,,	,,

TABLE OF STRENGTH AND LUNG CAPACITY.

	Strength of Right Hand.	Pull with both Hands.	Lung Capacity.
Borchgrevink	145°	66 lbs.	4700
Bernacchi	170°	70 ,,	5500
Colbeck	146°	72 ,,	4500
Evans	177°	92 ,,	6400
Hanson	160°	65 ,,	4400
Klövstad	135°	56 ,,	4980
Fougner	144°	58 ,,	4500

Averages.

English Element	167.6°	78 lbs.	5466
Norwegian Element	146.0°	61.2 ,,	4900

The above measurements were made soon after landing at Cape Adare, and with the exception of weight they altered very little during the subsequent months. In finding the averages, the two Finns have been omitted. It

(1) OLE MUST. (2) PERSEN SAVIO.

THE TWO NORWEGIAN LAPPS OR FINNS.

will be seen at a glance that the English members were on an average stronger, taller, and heavier than the Norwegian. The mean age of the whole ten was 27 years. Although small, the two Finns were exceedingly sinewy, and could stand any amount of cold and hardship. Unlike the Lapps Dr. Nansen had with him when he crossed Greenland, they were extremely energetic, and were always cheerful and happy. On a sledge journey they were seen at their best, for they were well skilled in the management of the dogs, and could work for hours beside the sledges without showing any sign of fatigue. Their quick intelligence and adaptation to European habits was astonishing.

On first joining they knew not a word of English, but before the end of the long winter night both could speak it fluently, and one, Savio, was able to read and write it with facility. The game of chess, at first utterly unknown to them, was soon acquired, and after some months' practice they became so proficient, that it took a most capable player all his time to beat them. They almost invariably wore their brightly-coloured native dress, which, during our sojourn in Tasmania and elsewhere, had attracted considerable attention. I know of no better clothing for Polar work than that of a Finn, from his "komargar" boots, which are filled with straw, to his warm four-cornered cap, which fits down close over his ears.

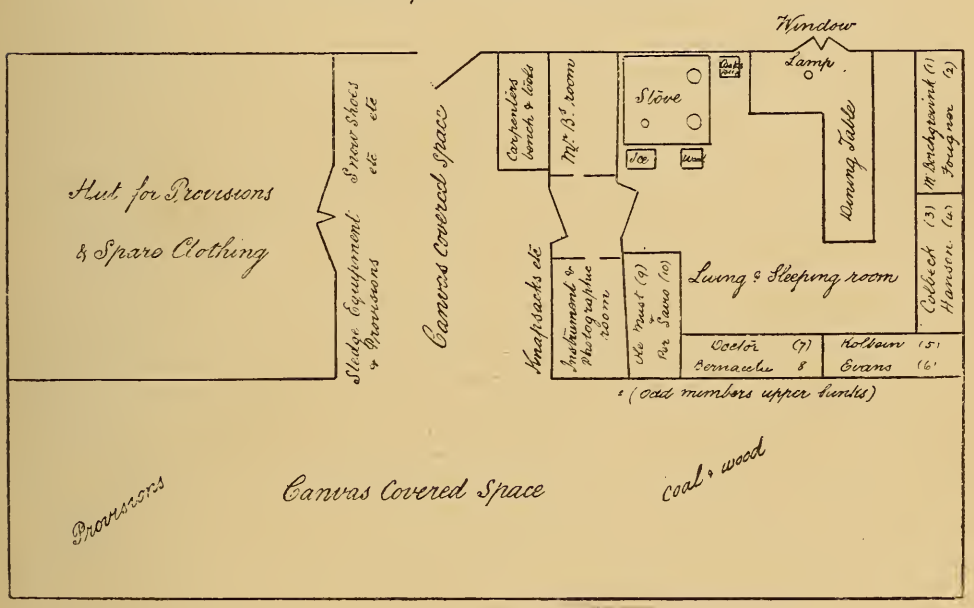
For some weeks after the departure of the ship we were busily employed completing the erection of our huts, and storing our provision and coal. We had two huts, constructed of pine logs in Norway, and put together at Cap

Adare; they each measured about 15 ft. by 15 ft. and were well adapted for our purpose, one being used exclusively as a store-house, and the other as a living-room. A foundation was made by picking out the pebbles to a depth of about two feet; then huge cables were passed over the roofs and firmly secured on each side. The huts were low, and on the windward side the roofs extended right down to the ground, so that the fierce winds from the mountains blew on to it and pressed the whole construction down towards the ground. But for this arrangement, there is little doubt that we should have been swept into the sea very early in our career. Sealskins were stretched over the roof, which very naturally conduced to keep the interior warm. After the first storm, drift snow gathered around the huts so as to almost bury them, which besides adding greatly to their security, very effectively kept in the heat. What with the double lining, double doors and windows, the want of ventilation, and the sealskins and snow outside, the living-room, when a fire was burning, became at times too warm, and after the winter, with its accumulated dirt of months, the atmosphere of the interior became so foul as to be almost unbearable. As a matter of fact, the dimensions of the living-room were too small to accommodate ten men comfortably.

The meteorological instruments were now set up, and the screen which contained them had to be secured with as much care as the huts. Observations were taken every two hours, from nine o'clock in the morning, until nine o'clock at night, and during the winter months this was done bi-hourly, right through the twenty-four hours.

Magnetic observations were also commenced in an open Finn tent by Lieut. Colbeck and myself whenever conditions were favourable. This delicate work was too often one of great vexation and personal inconvenience. The tent was situated at a distance of about 2,000 yards from the base of a volcanic and magnetic range of mountains, which undoubtedly had some influence upon the magnets.

Ground Plan of huts at Cape Adare.



The disturbances due to the occurrence of the aurora polaris were also great.

As we had no means of warming the interior of the tent, the observer suffered severely from the intensely low temperatures, sometimes having to observe in a temperature of -25° Cent., which was very disheartening when the results of his work, due to disturbances, were so frequently of little value.

The zoologists were now busily employed collecting speci-

mens of penguins, seals, and skua-gulls, these birds remaining with us until the end of March.

At nine o'clock in the evening of the 15th of March, we witnessed our first aurora polaris during clear, calm weather, the temperature at the time being 16° Fahr. The light first emanated in a waving curtain from the south-east, and went round to the south-west. The motion of the arrow-like beams, constituting the curtain, was rapid and at times would run along with an undulating motion, then suddenly shoot downwards towards the earth. These beams were of a nebulous whiteness, with occasionally a reddish tint in them. Varying in intensity, at times the display would almost fade away, but would again be renewed from behind the mountain to the east.

Seen for the first time, it was a wondrous sight, and to me appeared like some great search-light directed towards the earth from the depths of Infinity; it faded away at 10.30 p.m., and soon afterwards a dark cirrus-stratus cloud covered the whole sky. This first display, however, was very poor compared to some subsequently witnessed.

On Sunday, March 19th, an attempt at exploring the interior was commenced. A party, consisting of the Commander, Lieut. Colbeck and Mr. Fougner, set out with sledges, dogs and provisions for ten days. Just prior to the departure I was handed a letter which, in the event of a fatal accident to the Commander, instructed me to assume command of the expedition. We assisted the party to hoist up their equipment to the top of Cape Adare, which was extremely heavy work, and gave us some idea of what a gigantic task the hauling up of provision, etc., for an extensive inland voyage would be. Indeed, it became evident soon after

our landing at Cape Adare that any attempt to penetrate far into the interior would be futile owing to the rugged and lofty nature of the mountain ranges before reaching the inland ice visible beyond them. The Admiralty range of mountains in Robertson Bay is the most formidable range in South Victoria Land. Rising to an average height of about 7,000 feet, and partly free of snow on its northern slopes, it presents an impassable barrier to a sledge party.

Having assisted the small party over the first difficult portion of their journey, we started down again to our camp.

In descending we found an expanse of snow in a ravine, which extended from the top to the bottom of the Cape ; this, being soft and loose at the top, we entered upon without fear, but on reaching the middle we came to a surface of solid ice, over which we launched with astounding rapidity. Here Mr. Evans had a narrow escape from losing his life. Mr. Hanson and I were ahead, and managed to save ourselves in time by clutching an outcropping crag of rock, but Mr. Evans, behind, owing to his greater height, had quite lost control of himself, and was rolling down at a fearful speed. As he approached our retreat Hanson lay full length across the rock and caught him by his clothing as he was passing, and hoisted him up beside us ; but for this timely rescue he would have been precipitated to an almost certain death, 500 feet below.

The agility of one of the Finns was here astonishing ; he went swiftly down the steepest inclines with perfect ease, steering himself admirably the whole time.

The next morning a great storm was blowing. The wind, as indicated by an anemometer, was rushing along at a velocity of about 85 miles per hour. Our dog kennels were lifted up bodily, like so many match boxes, and blown out to sea ; it

was with the utmost difficulty that one could crawl against it. The wind, which was from the east south-east, blew for twenty-four consecutive hours, with an average velocity of 80 miles an hour, and at times, during heavy bursts, it rose above 90 miles. Drift snow blew down from the mountains in heavy masses, wrapping all in obscurity. In the early part of the morning a sudden gust had lifted up a large boat from the shore and dropped it into the sea, some 200 yards away. We all went down to endeavour to save what we could for firewood. The snow was blinding; it was impossible to hear each other speak, and when facing the wind, equally impossible to breathe.

The boat, now reduced to a complete wreck, was battering about among the ice-blocks, and a heavy sea, breaking amid them, drove the spray high up into the air. With considerable personal danger, Mr. Hanson leapt from one ice-block to another, until he reached the wreck and made a rope fast to it; to this we soon fixed a block and tackle and pulled ashore the remnants of what once was a ship's boat. Then our remaining large boat made signs of distress, and prepared for a speedy voyage; so we had to fasten the block and tackle on to this one, hoist it further inland and place cases, sacks of coal and rocks inside, to keep it from going off. Terrible work it was and bitterly cold, and, after we had finished, breakfast with hot coffee was very acceptable.

We had now grave doubts as to the safety of the exploring party on the mountain, but we could render them no assistance.

In the afternoon the explorers suddenly turned up, covered from head to foot with snow and with beards frozen. They had experienced a rather severe night, but not as bad as

might have been expected. Partly sheltered behind a boulder from the fury of the gale, the tent had withstood the assaults made upon it by the wind, and inside they were quite comfortable and warm in their reindeer sleeping bags.

Towards night the storm increased; a "kayak" * was blown into the sea, as if it had been a straw; the wind vane was broken, and the Robinson anemometer for measuring the force of the wind was demolished.

Although the storm came to an end on the following day a very heavy sea still swept the shore, and washed up some very fine shallow water specimens of crustaceous life, which were of immense interest to the zoologists.

On March 25th the temperature of the air fell below zero for the first time, and the sea in Robertson Bay commenced to freeze; on April 1st it was frozen over to a depth of several inches, but a gale which arose on the 7th broke up all this newly-formed ice and drove it out to sea. A few days after it was again frozen, and near the shore was strong enough to bear considerable weight.

Notwithstanding the great number of gales in March and April, magnetic, meteorological, and zoological work was steadily continued; in March alone, eleven checking days were experienced, when the velocity of the wind was forty miles an hour. A number of photographs were also taken at this time, but the developing of the negatives was a tedious matter. Every drop of water had to be produced by melting snow and the developing done at night in the hut when everyone had retired into his bunk.

We had the very best apparatus for photography, but the very worst arrangement for turning out good work. It was

* A kind of canoe made principally of canvas.

essential that all plates should be developed on the spot, but the dirt, the want of an adequate supply of water, and the cold, which frequently froze the solution while you were working, were a serious handicap.

On April 17th Mr. Fougner and I set out with a sledge and a team of dogs to examine the condition of the ice in Robertson Bay. We started early in the morning, and for the first few miles found the ice quite firm and level. At ten o'clock we stopped to rest the dogs, and killed a seal, which was basking alongside its hole, for their breakfast. The thickness of the ice was here found to be eight inches, the surface being quite free of hummocks. The geological formation along the coast consisted of lofty, basaltic cliff and containing parallel bands of rusty-looking formation.

Towards noon further progress was arrested by a large patch of open water about 200 yards in width, and which stretched from the shore far out to sea; we were therefore compelled to return to the camp.

On our way back we discovered a large cave in the volcanic cliff, a beautiful ice grotto, formed out of the rough rock, hewn out by the silent work of the sea and the grinding action of the ice. The floor of the interior consisted of floating blocks of ice, and from the roof hung a magnificent mass of icicles, some delicate and fantastic, others huge and polished like ivory, some gleaming with a thousand iridescent colours and glittering with the opaline sheen of mother o'pearl and others pure white, as the foam on high billows.

Silence, chillness and partial obscurity within; no sound but the weird crunching of the ice; the only movement, the gentle rise and fall of the icy-floor with the tide. Once a day, for a brief few minutes, the sun streams into this gelid cave

and tips the crystals with gold, and a broad band of bright light flows over the moving floor. Then this became a scene of surpassing loveliness, and from the outside looked like a golden entrance to some glorious fairyland.

Now that the bay was frozen, it was possible to take soundings through the ice, and this work was consigned to Messrs. Hanson and Evans. At a distance of 400 yards from the shore, on the north side of the camp, they found a depth of six fathoms, and at the same distance on the south side from sixteen to seventeen fathoms. The sea bottom to Robertson Bay is undulating, in this respect similar to the bank upon which we lived. Quite close to the land you find a depth of from seven to eight fathoms, a little farther out this diminishes to four or five fathoms, and then again increases and diminishes.

By making a hole in the ice and dropping a hook and line through it, a mild form of fishing could be indulged in. The fish were of two or three varieties and, on an average, six inches in length. Some were broad, large-headed fish like gurnets, and of various colours, and others small silvery species, with some resemblance to a herring. I was induced once to try this Antarctic sport, but tabooed it ever afterwards. For, after working like a navvy to make a hole in the ice, and then fishing for three long hours in a temperature considerably below zero, with all the gumption and constitutional laziness necessary, I only succeeded in catching one wretched sprat, and getting my hands and feet thoroughly frozen. The sport was even tamer than that at home, where the angler is generally in a position to return with a well-filled basket, even if he does not *catch* any fish at all.

On April 22nd another sledge journey was undertaken with

the intention of reaching the southern extremity of Robertson Bay over the sea-ice, but which very nearly terminated in grave disaster.

The party consisted of the Commander, Mr. Fougner, one of the Finns, and myself, and we took with us three sledges and twenty dogs, together with provisions, etc., for twenty days and a small collapsible canvas boat.

On setting out in the morning the temperature was a few degrees above zero and the barometer falling rapidly, with sinister warning of an approaching storm. We went along well for the first two hours; the ice was fairly strong, but getting thinner as we advanced. Towards 3 p.m. it commenced to get dark. The ice, too, became so thin that it would scarcely bear the weight of the sledges, and it was impossible to make further progress. Many patches of open water were visible in advance of us; and right down in the bottom of the bay a low, dark cloud indicated that there was no ice there at all. This cloud was visible from the camp in the morning.

We now began to search for a camping spot along the shore under the cliffs, but the ice there was so rotten and thin that it would not bear our weight. At this juncture, with open water ahead of us, and therefore no possibility of attaining the object of our journey, coupled with the rotten state of the ice, of course immediate return would have been the correct thing, as we had ample time before the subsequent gale arose. We thought it advisable to make every attempt to land on the shore, for if we went out to sea and a gale arose we would inevitably have been lost. We had frequently had examples of how rapidly the ice could be dispersed during a heavy blow from the E.S.E. We searched for

AN ANTARCTIC SHALLOW WATER FISH.

a landing place, and after some difficulty managed to reach the shore across some very insecure ice, and found a small hollow close to the water where a tent could be pitched. This hollow was at the bottom of a talus slope, formed by the disintegration of rocks from the cliff above, which rose up perpendicularly to a height of nearly 600 feet. This talus slope was about 50 feet high, covered with drift snow and ice from the spray of the waves, and it sloped up from the edge of the water to the face of the cliff, at an angle of nearly 60 degrees.

On the top of the slope was a narrow concave ledge, formed of snow, and averaging from one foot to four feet in width; this place, in the event of danger from the sea, would form a temporary place of refuge. It was decided to camp in this precarious spot.

Getting the dogs and sledges to the spot was no easy task, and we ran some danger of losing the latter and their contents, for the ice was so thin that it bent and broke underneath the sledges as they passed along. One or two of the dogs also broke through into the water. However, we succeeded at last in getting everything ashore and pitching our tent.

The sunset that night was a ruddy splendour of light, magnificent and wild. Watches were kept throughout the night of three hours each. I was turned out at 2.30 a.m. to take the third watch. The gale had already commenced. The night was densely dark and there was something ominous about the aspect of the sky. The frail silk tent began to flap in the darkness as the gale gradually increased. We were, for the time being, partly sheltered by the lofty cliffs, but the furious noise of the wind could be heard

outside. Suddenly, a terrible roar like the sound of artillery made itself audible above the wind, and the echoes rolled up among the rocks of the cliffs. Roar after roar succeeded each other in a way that may with perfect truth be termed appalling. It was the pack breaking up!

Black shadows appeared and quickly disappeared in the darkness like phantoms. These were patches of water opening and closing, as the ice broke up. The great darkness, the noise of the wind, the thunderous roar of the pack, and the weird shadows constituted a scene of awful grandeur. How infinitely small and impotent one felt before those sovereign forces of Nature!

At 5.30 a.m. I awoke the commander for his watch and turned into a sleeping-bag. At that time the wind was increasing, and the sea had already commenced to break on the shore. At about 7.30 a.m. we were hurriedly awakened in order to save ourselves and our equipment, but it had been left until rather late. We had only just crawled out of the tent when three huge seas followed each other in quick succession, striking one sledge and dashing the white foam over the tent.

We worked below for our lives, and succeeded in taking down the tent and putting it and the sleeping-bags upon the lightest sledge, which was then pulled up out of reach of the sea. We next set to work to save the provision-sledge, but this was a most arduous task, on account of its great weight; and it was only by inches that we moved it. The last thing to save was the collapsible boat. It had been washed off its sledge by the seas, and the Finn and I had to lift it on and make it fast, many seas dashing up and over us as we worked.

At last everything was safe and we were able to rest from

SLEDGES AND DOGS.

our exertions; "rest," such as it was, in the bitter cold and drenching spray. The seas had carried away most of the dog food; also a changing box for our camera, with some photographic plates and all the provisions we had out for supper. What a whirling and fearsome mass of Antarctic waters raged beneath us! No sign of ice; nothing but sheets of spray and the dull beating of the sea at the base of the slope. The fury of the blasts was at times fearful, and the spray dashed right up to the narrow ledge upon which we were standing. A huge mass of ice-blocks on the shore, to the left, partly sheltered us from the seas, but for which they would probably have reached the ledge and washed us off.

The storm continued all day, and it was only towards the late afternoon that the sullen skies began to clear. The sea still lashed the shore with angry thuds of passion, but the strength of the wind was gradually sinking. About 8 p.m. the sky cleared completely, the stars shone forth brightly, and the light of the moon shot across the waters of the bay. It was decided to take watch that night, two and two, of six hours each. The Finn and I took the first, from 8 p.m. till 2 a.m. It was more like six months than six hours; no period has ever appeared so long or passed more wearily.

The Finn crawled underneath the rocks of the ledge, with his reindeer "pesk" and half-a-dozen dogs for blankets, and promptly went to sleep most of the time. Therefore I was left alone pacing up and down, hour after hour, on the narrow ledge, scarce three feet wide and only thirty feet long. It was bitterly cold, the temperature being about 10° Fahr., so one was compelled to tramp up and down to prevent freezing. Occasionally I would stop and rest upon a sledge for a few

minutes, but the bitter, penetrating cold soon caused me to jump up and commence the monotonous march again.

At about 11 p.m. the moon became visible over the edge of the cliff, and threw its pale rays upon it and the slope and tent; but soon it was obscured by clouds, and all was gloom again. It was a weary vigilance, and I most heartily cursed the circumstances that had placed us in this predicament. I aroused the Finn at midnight, and kept him tramping about. He appeared to be very miserable and persistently asked me: "Hvad er klokken?" (What is the time?) At last our watch was at an end, and we awoke the other two and turned in ourselves.

The next day the gale was at an end, although it was still blowing fresh in the forenoon. By going down upon the ice-blocks it was possible to see the camp at Cape Adare, and after waving some time, a flag was hoisted there, to let us know that we had been seen, but they were quite powerless to render us any assistance on account of the high wind. We were now completely cut off. Above us towered the perpendicular cliffs, and below was the sea, clear of ice; the aggravating part was, that we were in sight of the main camp.

Towards the afternoon the wind dropped almost to a calm, and Mr. Fougner requested permission to make an attempt to reach the huts by means of the small collapsible boat, but the request was refused. This was at 3 p.m. At 8 p.m. the commander desired Mr. Fougner and the Finn to set out for the camp in the boat. It was now dark, with a full moon occasionally breaking through the clouds. We launched the boat and placed a little food in a haversack in her, then the two got in, pushed her off, and rowed away rapidly into the darkness.

They had not been gone long when all at once an uncanny

and portentous silence seemed to prevail; the lap of the waves on the shore was silenced. At that moment the clouds cleared momentarily before the moon, and we were astonished to see that the bay was full of sludge-ice. I went down to look at it; it was of the consistency of porridge. We now thought of the boat and its occupants, knowing that if they had been caught in this ground-up ice with a frail canvas boat they would fare very badly indeed. I was in hopes they had succeeded in avoiding it, but the commander thought differently, and subsequent events proved him to be correct. We turned into our bags very early that night and slept soundly, notwithstanding our somewhat cramped position.

Next day I endeavoured to reach the camp by going along the shore. We cut steps in the ice-slopes for some 180 feet, and I was then lowered over its edge at the end of a rope for a distance of about 70 feet. Taking advantage of the low tide I started along the frozen shore, but did not get very far before being stopped by a small inlet running into the slope. This was unfortunate, for I could not return by the way I had come, as the tide had risen in the meantime. I was therefore compelled to return by the steep and slippery slope, which was a long and dangerous task. At night we were considerably disturbed by showers of small stones falling upon our tent. These stones from the cliff above only fell during the night when the temperature of the air fell to any great extent. The daily change in temperature caused the porous volcanic rocks of the cliffs to alternately expand and contract, and the rapid nocturnal contraction produced such a superficial strain as to cause the surface to crack, peel off in irregular pieces, and fall. The débris at the foot of all these cliffs indicate how great is the disintegration due to changes of temperature.

Towards noon of the next day (26th April) we suddenly espied two men appear over the ice-slope to the north. They were soon recognised as Fougner and the Finn, and had the appearance of being thoroughly done up. On reaching camp Fougner, who was much fatigued, related his adventures since leaving us on the evening of the 24th. They had, it appeared, rowed along the shore for about half an hour, when they were caught in the sludge-ice, and had great difficulty in getting the boat to land, the ice pressing her on all sides and threatening to grind its way through her. On reaching the shore they, fortunately, secured a seal, the blubber of which provided them with fuel for a fire.

On the 25th they had endeavoured to reach us by cutting steps in the ice-slope round the shore, but only succeeded in cutting the steps half-way. Early next morning they continued their work and reached us about noon. They were both thoroughly worn out, having had no sleep during the whole period, and so, after having partaken of some warm soup, they crawled into our reindeer sleeping-bags and slept without a break for fifteen hours.

The 27th was another gloomy and miserable day. A gale from the south-east blew all the afternoon and night, and a terrific sea raged at the base of the slope, dashing the spray upon the tent, where it immediately froze. There was no sleep for anyone that night. We lay shivering in the tent, expecting every moment to be washed off the ledge into the sea.

Next morning the weather had cleared somewhat, and it was decided to make an attempt to scale the cliff from the place where Fougner and the Finn had camped on the 25th. Just before starting I cut my hand very severely whilst

opening a tin, severing some muscles and reaching the bone. It was bound up as well as possible, but was a source of considerable inconvenience later in climbing the mountain, as only one hand could be used. We started along the slope in single file, the Finn going first and I last. The whole pack of dogs followed close on my heels and would frequently endeavour to rush past, with some danger to one's balance on the slippery incline.

The spot was reached in about two hours, and then the ascent of the almost perpendicular cliff commenced. It was a most perilous climb, and took about four hours to reach the top (600 feet). So steep was it that none of the dogs could follow us; one, however, nicknamed Bismarck, very bravely stuck to us for three parts of the way, and then somehow lost his equilibrium and was hurled down to his death on the rocks below. On reaching the summit of the precipice we had a few biscuits to eat, but nothing to drink. It was already dark when we struck out for the mountain-top.

Slowly we wended our way up the steep side. We were compelled to go over it in order to reach Cape Adare.

It was a glorious night, but cold. Not a cloud in the sky; not a breath of wind. The stars shone forth in all their splendour; the Southern Cross overhead, the brilliant star Sirius flashing in the west, and the constellation of Orion low down on the horizon. Occasionally we rested and gazed on the strange and novel scene before us. A full moon in all its brilliancy lit up the bay, so that every feature in the weird and desolate landscape could be plainly distinguished. Away in the distance Mount Sabine, tipped with the silver rays of the moon, seemed the leviathan among that huge congregation of mountains.

The scene was wonderful and magnificent from its savage desolation. The deepest stillness prevailed—not even the slightest murmur rose from the ice below. All dangers, hardships and annoyances were forgotten. It was such a night as to fill the heart like a holy chalice with the rich wine of joy and gratitude; when Nature wears her most serene and noble aspect; when it seems good to live, good to work, good to hope, good to love—good to be even the smallest portion of the divine and splendid order of the Universe.

Hour after hour we continued our way, following a jagged ridge of rough volcanic rocks. The top seemed very far away, and we were very tired; 3,000 ft., 4,000 ft., 5,000 ft., and yet we were still a few hundred feet from its summit. The solitude was immense, no sign of life anywhere; not a bird; not an insect; not a vestige of vegetation. An absolute sterility prevailed. One became strangely intoxicated with the silence and utter lack of life. Strange and solemn regions of the South Pole! For how many centuries has the same awful solitude existed and for how many centuries will it still continue?

On reaching the summit an icy wind blew on our faces; the temperature must have been below zero, and we suffered badly from thirst. The Finn, who appeared to suffer most, made an abominable concoction of pure spirit and jam, which he seemed to enjoy. In descending the commander and the Finn forged ahead and reached camp somewhat before us. Hanson, good fellow, met Fougner and me at the base of the mountain with a bottle of water. How delicious it tasted! How pleased we were to return to warmth and comfort, after our trying perch on a ledge for six long days and nights. The little hut that evening was a palace and our hard bunks beds of softest down.

CHAPTER V.

"Winter armed with terrors here unknown,
Sits absolute on his unshaken throne;
Proclaims the soil a conquest he has won,
And scorns to share it with the distant sun."

—W. COWPER.

GREAT anxiety had been felt at Camp for our safety on Sunday; in fact, they had given us up for lost, thinking we must have been driven out to sea. On Monday they had seen us with the aid of a large telescope and had endeavoured to launch a boat to come to our rescue, but were prevented by the dense sludge-ice. The days were now very short and darkness and winter rapidly drawing nigh. The sunrise and sunset, due to the obliqueness of the sun's rays, were magnificent spectacles, the whole sky in the morning being a deep mauve hue; the snow-clad peaks of South Victoria Land were bathed in an effulgence of fiery light, and the immaculate whiteness of the icebergs and ice-pack were transformed into an exquisitely delicate pink. The sun at noon was only about 3 degrees above the horizon, becoming first visible at 10 a.m., then moving slowly along the horizon until 3 p.m., when it would set.

On May 2nd the sea again froze, and remained frozen to a depth of from two to five feet until the following December. The temperature commenced to fall rapidly during the second

week of May and rise again even more rapidly in the second week in October. The mean temperature for March was 17°.6 Fahr.; April 10°.1 Fahr. and that for May −3°.8 Fahr. The temperature of the sea during the time its surface was frozen remained constant at 28°.7 Fahr., and in the summer month it rarely rose above 32° Fahr.

On the morning of May 4th a gale burst upon us with great fury and with little warning; ten minutes before its first burst it blew in whirlwinds, then came a great rush, bringing with it tons of drifting snow. It was the strongest gale we had as yet experienced, and it blew with fearful potency all day. Just previous to the first outburst the barometer had commenced to fall and reached its minimum reading, 28.227 inches, just before the wind dropped at 9 p.m. These winds, always from the same direction, are a remarkable feature in the meteorology of the Antarctic. Some meteorologists have held that a vast cyclonic system and low-pressure area continues south as far as the pole, the more southerly parts being traversed by secondary cyclones; others contend that the extreme south polar area is occupied by a vast anti-cyclone, out of which winds blow towards the girdle of low pressure.

The prevailing east-south-east and south-east winds at Cape Adare (lat. 71° 18′), which is within the area of abnormally low pressure, tend to prove the existence of a great anti-cyclone stretching over the polar area, which in its turn necessarily implies the existence of upper currents from the north, blowing towards and in upon the polar regions to make good the drain caused by the surface outblowing south-easterly winds.

An anti-cyclone is a portion of the atmosphere in which the pressure is highest at the centre, and diminishes nearly

THE FROZEN SURFACE OF ROBERTSON BAY.

uniformly in all directions, and the winds blow spirally outward. A cyclone is just the reverse, and has the lowest pressure at the centre, and the wind blows in towards this centre of low pressure in a spiral curve.

The frequency and force of these gales, and the persistency with which they blew—always from the same direction, east-south-east—the invariably high rise in the temperature, and the sudden fall and rise of the barometer, the dryness of the winds—the relative humidity generally between 50 and 60 per cent.—and the motion of the upper clouds from the north-west, point to the fact that the South Pole is covered by what may be regarded practically as a great permanent anti-cyclone more extensive in the winter months than in the summer.* Nothing more appalling than these frightful winds, accompanied by tons of drift-snow from the mountains above, can be imagined.

On seventy-two days, or 20 per cent. of the time spent at Cape Adare, the wind blew from the east-south-east and south-east with a velocity above forty miles an hour, at which stage the Robinson anemometers were demolished.

On May 14th the temperature sank to $-31°$ Fahr. (63° below freezing point). During the day I accompanied Colbeck and Evans for a stroll towards the northern shore; somehow we always seemed to take our strolls in a northerly direction towards sunshine, and life, and home; rarely towards the silent and cold south. Here we found a large patch of open water; the ice in some inexplicable manner had broken up during the night and large blocks were moving swiftly along the shore, apparently borne by the tide. Columns of dark vapour rose like altar-smoke towards the tranquil heavens; vapour in a

* See Meteorology at end of volume.

complete state of congelation. It attained a height of nearly 200 feet, and so dense that one could see no objects through it. It was a strange phenomenon in such a low temperature. The sea appeared like a great boiling cauldron; at times the

COLBECK. EVANS.

"SQUIBS." "JOE."

OLD CHUMS.

tops of the loftiest icebergs showed above the vapour, lit up by the rays of the dying sun.

When out walking the exposed parts of the body frequently got nipped, and you had to rub the part vigorously with snow to restore circulation. The hands fared badly, especially when handling instruments, for at those low temperatures metal burns like red-hot iron.

Night and day the temperature rarely rose above – 10° Fahr.; when the sky was clear it was usually – 20° Fahr., but as soon as a little low stratus or nimbus cloud appeared the temperature rose rapidly; the lowest temperature usually occurred just before sunrise.

An ordinary thermometer placed outside in such a position as to face the sun registered lower than those in the thermometer screen, thus indicating that at this time, a few days prior to the departure of the sun, there was no direct heat from its rays, even when the sky was perfectly clear.

On May the 15th we saw the sun for the last time for 72 days; it not appearing again until the 29th of July.

The long, long changeless night of winter was now upon us with no light but that of the moon and the weird Aurora Polaris. The landscape, bereft of the genial rays of the sun, lay as if frozen into sculptured stone. Gone the Great King of Light: the glorious god Helios, source of Life, and Light, and Heat.

"The representative of the Unknown
Who chooses thee for his shadow!
Thou chief star!
Centre of many stars! which mak'st
Our earth endurable and temperest
The hues and hearts of all who
Walk within thy rays!
Sire of the seasons! Monarch of the climes
And those who dwell in them!
For near and far, our inborn spirits
Have a tint of thee,
Even as our outward aspects.
Thou doth rise and shine and set,
In glory—Fare thee well!"

—BYRON.

It is scarcely possible to adequately comprehend how much

we are indebted to the sun even for the principle of our own existence. It is the direct and indirect agent of all the vital transformations which occur on our planet. Without it, all would die, and deadly cold and awful solitude would reign. Nature on the earth's surface would acquire a poor aspect. We look with compassion on those human beings who regard the sun as a deity, which is rather surprising, when we are all so very much indebted to the star of day. I remember when at college being struck with these lines in the first book of Virgil's "Æneid," where the old harper is singing before Queen Dido and Father Æneas, "*Hic carnit errantem Lunam solisque labores unde hominum genus et pecudes.*" (He sings of the wandering moon and of the works of the sun, whence sprang the race of man and the beasts of the fields). But Virgil was a Pagan bard, and does not count in such matters!

We watched the departing sun as it slowly skimmed along the horizon like a tired traveller after a long weary march; and yet it seemed reluctant to leave us and to depart with a certain amount of regret, for even after it had dropped below the horizon a deep red afterglow remained in the sky, and a lurid crimson flush lingered caressingly on the distant snow-peaks for some hours afterwards.

The 17th of May is a great Norwegian holiday; it is the anniversary of Norway's separation from the Danish rule. So we celebrated it in a befitting manner by *ski* running, a sumptuous dinner, speeches, and fireworks at night; the *skiing* was greatly enjoyed. We tried jumping on them and sliding down a snow slope about 70 feet high and steeply inclined. Some severe falls resulted, but no injuries; it is strange that one is not hurt in these falls. On starting from the

top you place your *ski* together, bend the body forward and away you go, slowly at first, then faster and faster, gaining speed by your own momentum. Faster and faster still you fly, like an arrow speeding from a bow; it almost takes your breath away, and unless you bend well forward, your feet fly from under you and down you come before expectation.

Near the bottom a step or sledge of snow awaits you, from which the jumps are taken (by the Norwegians). Whizz! you shoot over it into the air, invariably turn two or three somersaults, and then the slope ungraciously comes up to meet you and you get an unpleasant bump. Covered with snow, so as to be quite unrecognizable and with the wind completely knocked out of you, you climb up the slope again, which is really hard work with *ski;* start again with a flourish, only to meet with the same ignominious end. Fine sport truly, and most exhilarating—strengthens the wind, the muscles, and the osseous parts of the body!

At midnight we held a torch-light procession along the shore, which must have somewhat astonished the seals asleep out on the ice. A rather amusing incident occurred here. It was very dark, impossible, in fact, to see a foot ahead. Suddenly we got into some very heavy snow, knee deep. Hanson and I were some distance ahead leading the way, and the others behind singing and following our light. We quickly put out the torch by driving it down into the snow, then ran as fast as possible right round them and came up behind. On they went, soon they noticed that our torch had gone out and they knew not which way we had gone; they were completely baffled, and started to meander about in a circle calling out for us. Suddenly we hailed them from

behind, and when they came towards us we shifted ground pretty rapidly to another side, and so on for quite an hour. They were lost and had not the vaguest notion in which direction to turn, and were wading about in deep snow with slippers on in a temperature below zero! At last they struck up Rudyard Kipling's "Gentlemen Rankers," "We're poor lost lambs that have lost our way, bah! bah! bah!" and having compassion upon them we came up.

On the following day, another great storm blew from the E.S.E. Our anemometer was completely demolished, being broken off across the bottom of the dial box and twisted up as if it had been in a blacksmith's forge. The wind blew with a velocity of nearly ninety miles an hour, and the barometer fell to 28·474 inches. The hut was soon completely buried in a snow-drift. It is interesting to note that as soon as the wind shifted a little to the south of E.S.E., the fury of the gale subsided, and the temperature began to fall.

In the evening of the 22nd May we witnessed a most grandiose and impressive scene. It was a beautifully calm night, no wind, no clouds, and a moon nearly at the full. The barometer, during the early part of the morning, had fallen just a shade below 29 inches.

We were having a quiet game of solo whist, when at 7 p.m. Evans went out to read off the meteorological instruments and came back and asked us to come out quickly and hear the noise of the ice-pack; such a noise as he had never before heard. We went out; a deep sonorous roar was audible like the din of battle; a battle indeed! A great battle of Nature was raging. We rushed down towards the shore from where the noise came, and on reaching it a sight

RESULT OF THE ICE PRESSURE OF MAY 22ND.

met our eyes which baffles description; a scene absolutely frightful in its grandeur.

Right along the N.W. shore, from which, half-an-hour before, one could see for miles and miles across the pack, a moving mountain of ice had risen up; a sudden and terrible pressure had set in from the N.W., and was piling the ice on the shores. It extended for about 800 yards, and was on an average 60 feet high; the mass was moving the whole time and advancing upon the land. The grandeur of the spectacle was immense. There is nothing comparable to it, and words can in no degree convey an idea of the majesty of the scene.

Huge blocks of ice thousands and thousands of tons in weight were lifted up 70, 80, and 90 feet with irresistible force to the top of the mount. There they would totter for a few seconds, and then come crashing down with a reverberating roar, sending up white clouds like steam into the air; not one, nor two, nor three blocks at a time, but thousands. At times great yawning gaps would appear in the mount, and the whole side would bulge out until with a fearful crash it would burst, and great blocks of ice fly into the air like so many straws. The noise of the pressure resembled the noise made by the pistons of a large steamer. At other times the noise would stop quite suddenly, and a perfect halcyon prevail for a few minutes; then quite swiftly it would commence again. There was a subtle magic about it all. Sometimes it made a strange moaning wail, as if some spirits were shut up within and begging piteously to be released from their icy fetters. Over all shone the bright white moon, giving the appearance of another world to the whole scene.

The pressure ended at about 8.30 p.m. and all was quietness

and serenity again. It was possibly caused by a strong gale to the N. or N.W., or by some tidal effect, the moon being at the time three days from the full and about on the meridian. The dogs barked furiously all the time at the tumbling blocks.

The birthday of Her Most Gracious Majesty Queen Victoria was celebrated right loyally. We arose early and decorated our magnetic tent with small Union Jacks. Mr. Evans that day most superbly filled the functions of *chef-de-cuisine*, and we had an admirable repast in the evening. Soon after dinner the toast of the Queen was drunk and three cheers given, then all standing up and joining hands we recited those beautiful lines of Tennyson—"Hands All Round." Then followed a lively controversy upon Australia and her politics; all manner of aspersions being made by some of our party. So, being an Australian, I had to take up the cudgels in her defence, and in an indignant and eloquent and inspired harangue contended that Australia was the greatest of all the colonies, the most thoroughly English, and the most loyal, simply because she is not a conquered country, and to support the argument quoted those beautiful lines written some years ago by an Australian:

"Not 'mid the thunder of the battle guns,
Not on the red field of an Empire's Wrath,
Rose to a nation Australasia's sons;
Who tread to greatness Industry's pure path.
Behold a people thro' whose annals runs
No damning stain of falsehood, force, or fraud;
Whose sceptre is the ploughshare—not the sword—
Whose glory rests in harvest-ripening suns!
Where 'mid the records of old Rome or Greece
Glows such a tale? Thou can'st not answer, Time.
With shield, unsullied by a single crime,
With wealth of gold, and still more golden fleece,
Forth stands Australia, in her birth sublime,
The only nation from the womb of Peace!"

—PERCY RUSSEL.

ENTERING THE HUT AFTER TAKING METEOROLOGICAL OBSERVATIONS DURING A STORM.

Very sweet and powerful lines and very true.

The next day another heavy gale burst upon the little camp, during which an accident happened which, fortunately, terminated happily, but which might have been most disastrous.

It was Evans' turn to read off the meteorological instruments, and a dangerous task it was when those great storms were blowing, bringing with them tons of blinding drift-snow.

He went out at about three o'clock in the afternoon, and after a few minutes returned, saying that his light had blown out, and that he had had to crawl back to the hut on all fours. Having re-lit his lantern he went out a second time, and after he had been away for nearly half-an-hour it struck me that he was unusually long, so I went to the door and looked out. All was as dark as death; one could not see a foot ahead for the whirling snow, and could hear nothing but the roar of the wind. There was little doubt now that something had happened, so we all put on our wind-clothes and turned out to search for him. No sooner out of the door than we were dashed down to the ground by the force of the wind; the drifting snow was blinding. The meteorological screen and magnetic tent were first searched, but there was no sign of him there. He had completely and mysteriously disappeared, and we had grave fears as to his safety.

The shrieking storm which dashed one repeatedly to the ground, the blinding snow which cut one's face like a knife, the dense obscurity, the cold and the dreadful chaos everywhere constituted a scene not easily forgotten. We now started to search in grim earnest. Colbeck and I attached a rope to each other and commenced to zig-zag from one shore to the other, but we could see nothing, hear nothing, but the

bellowing of the wind. Time after time we knew not where we were, being completely lost. Again and again we called out simultaneously with all the power of our lungs; we could scarcely hear the sound of our own voices, so drowned was it by the wind. Our hands became stiff and numb, our hoods filled with snow, and pads of ice formed over the eyes and mouth and brows, until we were at times quite blind. It was impossible to breathe when facing the wind, and again and again we had to bend to the ground to avoid its furious impetus.

We had been out nearly three hours when we deemed it advisable to return; but this was easier said than done, for we had great difficulty in finding the hut, and when we did find it we had to drop on our hands and knees to enter, so powerful were the whirlwinds around it. When we got inside, behold, there was the lost explorer, apparently not much the worse for his adventure. He had just been found by Fougner blindly wandering about close underneath the mountain, with the shattered remains of a lantern in his hand; fortunately for him he had on his wind clothes and mits, and had not been severely frost-bitten. He had been lost for nearly three hours in a heavy blizzard, at a temperature of 2° below zero Fahr.

It appears that he had succeeded in reading off the instruments, but on his way back to the hut a furious gust of wind had dashed him violently to the ground, extinguishing his light. Half stunned and completely bewildered in the great darkness, he picked himself up and started off in the direction he thought the hut lay, but he missed it, and becoming more and more mixed, wandered about aimlessly until found. Some of the members were severely frost-bitten on the face and hands during the search.

About this time a very fine specimen of an Emperor Penguin was caught out on the ice-pack; a big, sad, solitary bird, over 4 ft. high. The presence of these birds so far south late in the year proves that they do not migrate far north during the Antarctic winter.

At this season of the year the curious and impressive spectacle of the Polar Light was frequently observed. This, which in the Northern hemisphere is the *Aurora Borealis*, is, in contradistinction, called the *Aurora Australis* in the Southern hemisphere. In appearance, however, they differ very little. The *aurora*, as is well known, is a phenomenon at the same time cosmic and terrestrial, which on the one hand is confined within the atmosphere of our globe, and stands in close connection with terrestrial magnetism, and on the other hand is dependent on certain changes in the envelope of the sun, the nature of which is as yet little known.

At Cape Adare, which is probably within the area of greatest aurora intensity in the Southern hemisphere, particularly favourable opportunities are afforded for its study. During the cold months the atmospheric conditions are most favourable, the amount of cloud being small. In the winter the phenomenon was seen nearly every night, so it was possible to establish the diurnal period, for it usually manifested itself between 6 p.m. and 3 a.m., its maximum intensity being generally reached between 8 and 9 p.m.; of course there were exceptional cases. The intensity also appeared to be much greater at the time of the equinoxes than during the mid-winter month, the displays being more brilliant and more rapid in motion at the former time. They were, however, most frequently seen during July and August.

At Cape Adare (lat. 71° 185′) the aurora was generally

observed in the north, very rarely in the south, and it always manifested itself in exactly the same manner. Diffused aurora light would first appear in the north about 3° above the horizon; soon afterwards a gigantic luminous arc would form above the diffused aurora, the extremities resting on the horizon, while the apex was situated a little to the west of the magnetic meridian. The luminous arc generally formed the starting-point for the radiant draperies of rays, of variegated colours, and with indescribably beautiful and graceful folds, which moved laterally and most rapidly from east to west, and bodily towards the zenith. Long shafts of light would shoot down towards the earth with incredible rapidity, the colour being of a much deeper red at the lower part of these shafts than at the upper.

The intensity of the colour appears to have some connection with the altitude of the phenomenon, varying greatly with the density of the atmosphere. In other words the colour of the aurora beams is an indication of its height above the surface of the earth, being deep red at a low altitude and of a pale nebulous whiteness at great altitudes.

But what was of greatest interest in the observation of the aurora was the connection which appeared to exist between it and an approaching atmospheric disturbance. A strong gale from the E.S.E and S.E. was almost invariably preceded by a most brilliant and rapid aurora display. This was not a mere coincidence, but a fact repeatedly observed. It was also possible to predict an approaching storm many hours beforehand by the extreme agitation of the magnetic needle; both possibly being manifestations of the same cause.

At 10 o'clock in the evening of June 3rd an exceedingly grand aurora was visible. It was a dazzling and incomparable

spectacle, and first manifested itself in the usual manner by a luminous display in the north. Soon the coloration became brighter and livelier, and developed shafts and waves of light which moved rapidly towards the zenith, becoming brighter and more rapid the whole time. At first it was of a fleece-like nebulous whiteness of a strange unearthly radiance.

When at the zenith and almost due E. and W. the aurora attained its maximum intensity; great curtains of light would shake themselves across the sky with undulating motion in an especially striking manner; huge shafts of red and green light would shoot down towards the earth with a rapidity impossible for the eye to follow; palpitations of an unknown life. Once the streamers collected round a spot in the zenith and formed a luminous ring of a deep colour; a colour of celestial opulence impossible to define, and turned around in a small circle with a rapidity that was appalling; no sound whatever was perceptible. This, however, was only a transient phase, for the flow of streamers gradually faded away, and the whole display lost its brilliancy and rapidity of motion in about an hour, leaving a glow in the sky like the dying embers of a great fire.

It is impossible for one who has not seen it to even feebly understand its great beauty. How little we understand the nature of its origin. It appears as if Nature has reserved for those cold climates of the pole its most astonishing, soul-inspiring, and baffling phenomenon.

CHAPTER VI.

"Still to ourselves in every place consign'd
Our own felicity we make or find."
—GOLDSMITH'S *Traveller*.

POOR old human nature is the same the world over, whether it be in a populous social centre or within the great silent circle which surrounds the South Pole; hence it follows that a handful of men who are thrown together day after day, month after month, become somewhat irascible and impossible towards one another. But surely it would be tedious to continually refer to all the small annoyances, the satiety of each other's company, and the sentiments of melancholia which, to a certain extent, are inevitable during a long polar winter; it would not interest the reader a bit, for these are things with which we are all more or less acquainted and to understand them is to forgive them.

The long polar night is dismal, very dismal, and in the terrible loneliness of that uttermost part of the world character may well grow crabbed and gnarled. Still this dismalness can be enhanced or diminished according to the individual temperaments of the party.

No one who is not young and strong, and devoid of acute sensibilities, should ever spend a winter in the polar regions, whatever other qualification he might have, for one does not

easily become acclimatised to the conditions of life. In our case, being all young and in the full vigour of life, we suffered less than others who have been placed in similar circumstances. None of us suffered in any way from lowering of the system or from heart trouble, nor did anyone become nervous, excitable and sleepless.

We were now (June) in the middle of the Antarctic winter, which, by the way, is longer than the Arctic. In his annual round the sun tarries a week (7¾ days) longer on the north than he does on the south side of the equator, and consequently, in the former case, the winter is longer than in the latter. This is due to the earth being, during the Antarctic winter, at its greatest distance from the sun (aphelion) when it moves more slowly in its orbit.

The sun remained constantly below the horizon from May 15th to July 29th. It was not, however, absolutely dark all this time ; for when the sky was not overcast the twilight produced an hour's daylight in the middle of the day even at the winter solstice.

At times it was intensely cold, the thermometer remaining for days at −30° Fahr. (62 below freezing point), but there were occasionally very great and rapid variations in temperature due to the passage of storms, when the mercury would rise from −35° F. to +20° F. in a few hours.

Regarding June, July, and August as the winter months, we may take it that the mean winter temperature is −11°.3 Fahr. However, the bald statement of an average value gives no idea of the extent of variation among the actual figures from which it has been derived.

In that iron clime the conflicts that have been between heat and cold are stupendous. The flame-scarred mountains and

shattered stratifications heaped up along the coast are relics of the battles these forces have waged long years ago. The same battle is still going on in the meteorological machinery; a giant contest that has existed and may exist for many millions of years.

But notwithstanding the resistance afforded by the scorching subterranean fires and the gleaming orb of day, the implacable cold will, doubtless, in the long, long run, assert itself and gain the ascendancy, and will envelop the whole world in its folds, filling its hollows with icy masses, and sweeping the germs of life from its surface. At last it will penetrate to its heart. No solar beams will enliven its surface. Darkness and deadly cold will reign instead, and of the influences, so many and profound, which the sun exerts upon our planet, nothing will remain. That infinitesimal speck in the Universe, that was once the scene of so much life and gaiety and beauty, the seat of so much pride and vanity and ambition, the centre of boasted erudition, will have sunk into a meaningless past.

Very little work was possible during the dark cold months, so we waxed fat and apathetic out of pure inertion and sloth; it was a life of merely bovine repose. Whilst our godliness was indisputable, as much could scarcely be said for our cleanliness. Ablutions were rare on account of the difficulty of melting the snow to procure water, so we were soon disguised in dirt; a disguise made more effective by the growth of long patriarchal hair and beards, which really saved a peck of trouble in the way of shaving.

The dietary régime was as follows:—Coffee for whoever got up before 11 a.m. (which was not often). Breakfast at 11 a.m. and dinner at 5 p.m. Seal flesh was eaten

THE HUTS AT CAPE ADARE DURING THE LONG WINTER.

whenever it could be procured, but seals were scarce and difficult to get in the winter time. In the following summer, however, seal and penguin flesh was eaten every day, and undoubtedly conduced to our good state of health. Kolbein Ellifsen, a young Norwegian, undertook the thankless duty of cook, with all the usual opprobrium such a task involves.

An attempt was once made (how vivid the recollection is still !) to distribute the culinary art equally among the party, taking turn and turn about, but with such painful results that it had to be vetoed.

One of the saddest spectacles of all was some bread made by the Commander, which in moments of enthusiasm he referred to as an Australian damper! It is still in the Antarctic regions on the left hand top corner of the shelf inside the hut; we kept it for an emergency food, and it now awaits the next expedition!

For recreation we used to play cards and chess a great deal, read many hours, and sleep more. Occasionally a gloom would envelop the mind in as thick a canopy as a London fog, and one yearned towards light and pined for social life and company, even for that of amiable stupidity; but this passed away with the return of the sun.

The polar night might have one advantage if it were not so far from civilisation: when a creditor called upon you, you could request him to drop in again in the morning.

There was very little to break the monotony or to create excitement. The Poet Laureate of Cape Adare—whose identity we will mercifully not reveal—now and then broke out in funny jargon, which might have made dead poets turn uneasily in their graves, but which we hypocritically applauded.

One evening in the middle of June, when nearly all had retired for the night, some busybody accidentally discovered in "Whitaker's Almanac" that it was somebody's birthday or marriage day—I have forgotten which—and we were requested to turn out and take part in the hoisting of the flag to celebrate the occasion. So we tumbled up and dressed, not without giving expression to some soft language, and passed from our warm bunks into a temperature of $-35°$ Fahr.

The flag was hoisted and a rather sickly cheer given; then a cask containing crystallized paraffin was set ablaze, and great sheets of flame rose up in the clear cold sky. The performance terminated at midnight.

On Sundays there was a little variation, for in addition to the loud and strong choral service intoned to Morpheus from every side, the Finns, in most sepulchral tones, would chant hymns of their own native language, and one "sucked melancholy from these songs as a weasel sucks eggs."

On bright calm moonlight nights we used to go for long strolls across the ice, and these nights were the realisation of one's idea of a perfect condition of repose.

There is something particularly mystical and uncanny in the effect of the grey atmosphere of an Antarctic night, through whose uncertain medium the cold white landscape looms as impalpable as the frontiers of a demon world. It was strange to watch the moon describing a complete circle in the sky, not setting for days at a time, but just coasting along the summits of the mountain ranges. The glorious constellation of Orion, the beautiful star Sirius, and many others, swept round the heavens in a great circle, crossing the meridian to the north and again to the south—visible the whole time.

One had actually before one's eyes the diurnal revolution of the earth in space. At such times one is mentally struck with the similarity between the moon and that part of the the globe ; a dead silent world above you, and a dead silent world at your feet; above, the vast mountains of the moon, beneath, the cold barren peaks of the southern extremity of our planet; but the lunar mountains are possibly more genial, for there, there are some mountains upon which the sun never sets—mountains of eternal light—whilst on the Antarctic mountains, added to the horrors of cold, and barrenness, and solitude, there is that of darkness.

A dog, which disappeared in April, suddenly put in an appearance on the last day of June quite fat and cheerful-looking. He had been blown out to sea with the pack during the heavy gale of the 23rd April, and must have been living out on the ice ever since. Upon what? A single dog cannot kill a seal.

He was not at all wild, was in as good condition as any camp dog, and his white coat had grown very long and thick.

In July, Mr. Nicolai Hanson, the zoologist, became unwell ; he suffered severely from headaches, and nearly lost the use of his legs, so that he was scarcely able to stir outside the hut. These limbs were swollen and dead to sensation ; needles could be driven in without inflicting pain. He appeared to have the symptoms of scurvy, although it was hard to account for the advent of that dreadful malady.

The doctor devoted much attention to him, and applied a galvanic battery daily, but without any appreciable effect, for he became steadily worse.

During the night of the 24th July, a serious catastrophe was narrowly averted, viz., that of having our huts burnt

down ; the most terrible thing that could have happened to us there. Being built of pine they would have been consumed in a few minutes, and we would have had little time to save anything. Exposed to that pitiless climate in the depth of winter would have been awful. One of the members, whose night it was to read off the meteorological instruments, carelessly left a lighted candle in his bunk close to the wall. The wall caught fire, and in a few seconds the whole bunk was wrapped in flame and dense smoke filled the room.

It was about two o'clock in the morning, and we were all sound asleep, when the suffocating smoke awakened us, and after some difficulty the flames were extinguished, but not before a fair amount of damage had been done.

Great precaution was taken after this against a recurrence of the conflagration.

Towards the end of July, as the monarch of life and light rapidly returned to us, we rejoiced accordingly. The light became stronger and stronger day by day, and at noon when the sky was clear it was sufficiently actinic for taking photographs.

On the 27th July a fiery segment of the sun appeared above the purple horizon, and one felt like an anchorite catching a glimpse of the seventh heaven. For some days past a deep red band of light had been visible moving along the horizon, the *avant-courrier* of the sun so long absent. On August 3rd, we saw the whole disc of the sun in all his ruby robes, and it was with deep joy that we hailed his appearance after having been for so many days plunged in shadow. The cold white flats and distant mountain tops glistened once more in its glorious rays, and were illuminated with all the colours of the prism.

THE FROZEN SURFACE OF THE OCEAN, 1899.

Faces that had been seen for many weeks only by lantern light looked strangely pale in the light of day.

No one, with the exception of Hanson, seemed to have suffered much from the forced imprisonment. Outside everything was unchanged. The same huge fleets of ice surrounded us; the same crags and gleaming peaks.

August was the coldest month, the mean temperature being −13°.5 Fahr. (25°.3 C.). The extreme minimum temperature that we observed occurred on August 4th during perfectly clear and calm weather.

A little after 1 p.m. on that day the temperature sank below −40° Fahr.; at 9 p.m. it reached the minimum, −43°.5F. At those low temperatures the mercury thermometers were rendered useless, and spirit ones had to be substituted.

When mercury freezes in an ordinary thermometer it contracts so much that the column of mercury suddenly sinks in the tube. The position of the column is therefore no measure of the actual degree of cold.

I placed some mercury in a saucer and exposed it to the air; in less than an hour it was frozen solid and when tapped rung like metal.

The freezing takes place from below upwards. If, when it is half frozen, the fluid be poured away from the frozen portions we obtain groups of crystals composed of small octahedrons grouped together by the edges of the cube.

That mercury solidifies in cold was discovered by some academicians in St. Petersburg in 1759, and caused at the time a great sensation, because, by this discovery, various erroneous ideas were rooted out, which the chemists had inherited from the alchemists, and which were based on the

supposed property of mercury being at the same time a metal and a fluid.

A saucer of whisky, also exposed to the cold, froze in a very short time (ten minutes), and when frozen resembled candied sugar. It was novel to be able to eat whisky instead of drinking it.

The greatest period of cold arrived with the return of the sun. The vast masses of ice which surrounded us on every side, and which in the autumn gave up its latent heat to the air, thus delaying the winter, now in the spring took into itself what little heat there was from the sun, and, therefore, delayed the summer.

One had to keep moving about in those low temperatures for fear of frost bite. Notwithstanding the intensity of the cold, viz., 70° below freezing point, it is only the exposed parts, and especially that part of the face near the cheek bones, that are likely to be nipped; if there is the slightest wind it is positively dangerous.

The feet get rapidly frozen if you do not move about continually, and you are no sooner in the open air than the breath crystallizes upon the beard and moustachios; these are soon converted into a solid mass of ice, and become a source of much inconvenience.

Everyone evinced the greatest interest in the movement of the thermometer. "What's the temperature?" being a question repeatedly put, and many word battles were fought between the weather sages.

In the evening of the 4th a somewhat unusual aurora polaris was observed. It commenced a little before 6 p.m. in the form of a double luminous arc in the north. The arcs were separated from one another by two degrees, the

inner one being eight degrees above the horizon. The west extremity of the arc bore about north-north-west; the east extremity was invisible, being hidden behind the Cape. The arcs lay in the same plane and had a common centre.

Winding curtains of aurora afterwards manifested themselves in the usual way; the whole radiant display moved to

CAPE ADARE DURING THE WINTER.

the south of the zenith-like clouds, being driven before the wind until it disappeared in faint nebulous forms. The temperature at the time was $-41°.5$ F.

About this time, the Commander and the two Finns set out on a sledge journey to the southern extremity of Robertson Bay, and returned on the 4th of August after an absence of nine days. They brought back with them some interesting specimens of rocks.

On August the 6th Messrs. Evans, Fougner and I made a journey to an iceberg in the middle of the bay, in order to bring back three loaded sledges which the party had left there on the 4th.

The day was pre-eminently fine, with a clear sky and a temperature 62° below freezing point.

For the first mile the ice was rough, but afterwards it became comparatively smooth, and the dogs raced along it at a good speed. We did not feel the cold, but beards were soon blocks of ice, and we had to keep a watch upon each other's faces for frost bite.

Two dogs frivolously followed us and gambolled alongside the harnessed teams. Alas for them, they were hitched on to the sledges on the homeward journey, and they had ample time to lament their folly.

At about ten o'clock, the sun appeared from behind the Cape; it shone in the sky like a sphere of gold, and we revelled in its rays, and by an extensive stretch of the imagination opined them to be warm. In all truth we felt warm enough, running alongside the galloping dogs. The sunlight flowing over the ice converted it into a delicate pink, and the distant mountain ranges partook of the same beautiful hue.

The surface of the bay was frozen over in a continuous solid sheet to an average thickness of about four feet. During that cold weather the ice naturally became thicker and thicker. Here and there were huge tabular-shaped bergs, and in some places where the ice had "screwed," blocks were piled up in irregular heaps.

The extremity of a huge glacier at the bottom of the bay, which extended for some distance from the shore, was

considerably elevated by refraction, and had the appearance of being only a mile or so away, whilst, in reality, it was twenty.

We reached the iceberg in about two hours' time; it was a very fine one, tabular-shaped, about 300 yards in length and 100 feet in height. The sun shone on its truncated side

CHARACTERISTIC ICEBERG OF THE ANTARCTIC.

and transformed it into a blazing wall of gold, which was almost blinding to the eyes.

At the base of the wall lay three small specks—the sledges left there by the Commander, and for which we had come.

Near the foot of the berg there was a huge cave with beautiful pendant icicles, and half way up the wall there

was another, which Fougner and Evans vainly endeavoured to reach. We all succeeded, however, in climbing to the top of the berg from the opposite side where it was rather low.

The summit was flat and smooth, but sloped up gradually to one side. In two places there were large round holes with a raised nucleus in the centre of each, which seemed to have been formed by running water falling upon the surface when the berg constituted part of a glacier.

We walked to the brink and looked down 100 feet below. The scene before us was extremely fine. The setting sun lent a colouring to the sky that transcended anything words can express. The surface of the ice was a deep blue, and away in the north some dark bands of cloud were visible, denoting considerable patches of open water in that direction.

As it was getting late, we were reluctantly compelled to descend, and turn our attention to more material things.

The temperature was now 32° Fahr. or 64° below freezing point, and we commenced to feel cold. After partaking of some solid chocolate and a nip of brandy, which nearly froze the skin of the lips as it passed down, we packed the sledges and turned campwards.

The dogs returned in better style than they had come, notwithstanding the heavy load they now had to drag. One good dog was placed in the lead of each team, and he, with his nose down on the snow, followed the tracks left in the morning. They went so fast that we were at times left behind, but caught up again when the sledge got fast in some projecting piece of ice. When it grew dark matters became less pleasant.

There is nothing worse than walking over uneven ice at night. Although you can see well enough in a general kind of way, you cannot see the declivities and holes in the ice; consequently, falls and jars were frequent. About a mile from the huts, we ran into an expanse of "screwed" ice, which, owing to the obscurity, we had not perceived until we were upon it.

Here we had a heavy task continually clearing the sledges, which every few minutes would fall into some crevass or topple over across some hummocks.

Truly, dog driving at times has decidedly a bad moral effect when you have to address the canines in terms that are—well, not sweet and affectionate.

We reached the hut a little after six o'clock, having been away nine hours, and covered a distance of over twenty miles; a good day's work over uneven ice.

On August the 14th a party consisting of Evans, Fougner, Ellifsen and myself started on a sledge journey to the small island at the south end of Robertson Bay.

We had instructions from the Commander to build a stone hut there and to collect geological specimens. It would have been of great value and interest to have investigated the shore line in the direction of Smith's Inlet and Cape North whilst the sea was still frozen. We could have closely examined the whole contour, which might have yielded geographical and geological discoveries of much value; laid down accurately positions of headlands, inlets, glaciers, etc.; taken soundings close into the shore through the numerous open seal holes, and in addition acquired a most interesting series of photographs.

We took with us four sledges containing provisions, etc.,

for fourteen days, and twenty-eight dogs. The provisions proved sufficient to last more than double that time.

The weather on starting was anything but promising. The thermometer registered $-25°$ F.; the sky was overcast and the barometer falling. Bad weather, in fact, followed us persistently the whole time, and we experienced nothing but strong gales accompanied by drifting snow.

Two of the four sledges were loaded with provisions, another contained our personal apparel, viz.:—four reindeer sleeping bags, four haversacks containing arctic-socks for night wear, thick mits, wind clothes, medical case and other little personal comforts. In addition to his reindeer sleeping bag, Evans took with him a jaeger wool bag which he inserted inside the former; this subsequently proved of great comfort to him. The wool bag is light and very warm, and has the advantage of not freezing hard like the skin of the reindeer bag. The fourth sledge contained mining tools, drills, etc., 25 lbs. of gunpowder, cooking utensils, dog food and a silk tent. On the body I wore the following clothes (which on the whole proved too light for that time of the year, especially so on the lower part of the body. Although I was rarely troubled with the cold during the day when moving about, I felt it at night in the sleeping bag): on the upper part of the body a thick jaeger wool undershirt, then a jaeger wool "sweater" and a Cardigan jacket, and over these a leather jacket; on the lower part of the body a pair of thick jaeger wool drawers and a pair of thin summer trousers, which I had frequently worn in Melbourne in a temperature of 100° Fahr. On the head a woollen cap protecting the ears and the neck, and over this a Samoyede fur cap. On the hands a pair of reindeer fur gloves, which I had procured

SLEDGING DRESS.

from one of the Finns, and on the feet a long pair of thick jaeger wool stockings and "kormarger" or Finn boots filled with hay. These Finn boots are very well adapted for wear in polar regions; they have no solid soles and the toes run to a point and curve up. The boot is filled with hay or Norwegian "saennagras," and the foot inserted in the middle of it; the feet are thus kept perfectly warm and comfortable even in a temperature of −40° Fahr. The hands and feet, being the parts most susceptible to cold, require some attention. I had with me, besides, a reindeer "pesk,"* which however I never had occasion to wear.

The other members of the party were clad in much the same way. Before leaving camp glycerine was rubbed on the face and hands as a prophylactic against frost-bite, which, although it gave us a rather unctuous appearance and was uncomfortable, was very effective, and that was the prime consideration.

It was absurdly late to start, nearly 3 p.m., and we might just as well have waited till the next day. We set off at first quite cheerfully, one might almost say skittishly, but we had not travelled a mile across the heavy hummocky ice when the runners of one of the sledges collapsed, and we were forced to halt and repair them provisionally by binding on two long *ski;* this operation involved a considerable loss of time, and it was past four o'clock when we were again able to get under way.

We had hoped on starting to reach an iceberg, distant about ten miles, before it was completely dark. This delay shattered our expectation. In addition to this the dogs pulled lazily; they were in no particular haste to leave the

* Lapp fur coat.

camp, and having been fed just before leaving, were beautifully contented, and evidently opined that it was inconvenient to exert themselves unnecessarily.

The state of the ice was also bad, and every few minutes we were obliged to clear the sledges of some obstacle or other.

Directly a hummock was encountered, the dogs, with their usual instinct, immediately squatted on their haunches, looked perfectly enchanted at the occurrence, and regarded us complacently as we came up to give the sledge a start. I had no patience with them and struck them with my heavy fur gloves; this, however, proved more detrimental to the gloves than to the dogs, and tended to make confusion worse confounded, for as you aimed at them they leapt over one another to get out of the way, and tangled up their harness in a bewildering mess, and you would have to pull off your mits, and, at the risk of frozen fingers, disentangle it. Even when you did succeed in chastising one and disburdening yourself of some wrath, the tantalizing beast would avenge the blow by viciously biting his neighbour, who immediately passed it on to the next; and thus the biting and quarrelling would pass from one to the other along the line, until the whole team became a heap of pugnacity. The amount of cunning and perversity they displayed was simply astonishing.

By the time we had reached the iceberg at midnight, the rough ice, obstinate dogs, broken sledge, and the obscurity so ruffled our tempers that we were in a high state of ebullition.

We now had the cheerful operation to perform of pitching tent and brewing coffee, which, in a temperature of 62°

below freezing point, and after the exertion and irritations of the day, was highly delightful. I will not dwell upon it. Suffice it to say that we really enjoyed the hot coffee, after which the four of us managed, not without difficulty, to squeeze into the small polar tent by laying crossways. It was just four o'clock in the morning.

A TYPICAL SIBERIAN DOG.

The next day (August 15th) we turned out at 11 a.m. I had slept very little, having felt the cold intensely and suffered considerably from lateral pressure. Being at the bottom end of the tent alongside one of the small poles, I became the victim of the other three, and when I endeavoured to transfer some of the burden of the pressure upon the tent pole, that object resented the treatment and promptly broke.

The temperature of the air at 11 a.m. was −12° Fahr. After feeding the dogs we cooked breakfast, which, by the way, took an aggravating long time, and ate it in a cave in the berg overhung with icicles. The rays of the sun flashed directly into the cave, sparkling and glimmering upon the pendant crystals, and tinging the whole grotto with a rich warm light. Never was a fairy palace more lovely than this refuge which Nature had provided for us. Seated around on haversacks with the Primus stove and coffee-pot steaming merrily in a temperature of −12° Fahr., we presented the quaintest breakfast party imaginable. Considerable hilarity was caused at breakfast, when one of the party was avidiously eating some frame food jelly which, being partly frozen and very viscous, clung tenaciously to his teeth. On pulling it away, behold, much to his horror and our amusement, a large front tooth came away with it. The occurrence disturbed his mental equilibrium for some time afterwards. It was, however, an unpleasant way of having a tooth extracted, to say nothing of the disfigurement caused thereby.

A very fine refraction effect became visible between 11 a.m. and 1 p.m. Huge icebergs to the north, which must have been quite 30 miles away, and which, under ordinary circumstances, were invisible even from the huts, were elevated by refraction to a height on a level with the top of Cape Adare, the height of which is nearly 900 feet. The display, it can almost be called so, was ever changing in appearance; sometimes one part of the horizon was elevated, then this would subside and another part rise up. At this time of the year the coast line in the direction of Yule Bay and Cape North, nearly 100 miles away, was frequently seen on

clear days in consequence of the great rarity of the atmosphere.

The day was fine, and we could have very well gone on to the bottom of the bay but for the circumstance of the broken sledge, which we were compelled to repair. Having no proper tools, this took the whole day to complete, for new cross-pieces had to be made, and *ski*, securely bound with raw hide, placed over the old broken runners. It was cold work for the fingers. That night, as there was every prospect of a gale reaching us in a few hours, we made everything snug; tightened up the tent, attended to the dogs and sledges, and then had supper, smoked, and speculated upon the commercial value of the iceberg in a warm climate such as Australia, where ice sells for sixpence a pound.

On the next two days a gale blew from the E.S.E., and we were forced to keep inside our tiny silk tent, an insufferable ordeal for four fair-sized men who, in that small space, were cramped up in the most quaint and curious attitudes ever seen off a Japanese fan. You could not go outside even for a stretch, on account of the smothering masses of snow which completely buried the sledges and dogs. Every hole and crevice in the tent had to be stopped against it so that with the steam from our Primus cooking apparatus, and the smoke from our pipes, you could have dug out the atmosphere with a spade.

Yet, notwithstanding all this, and a temperature of 40° below freezing point, we managed to pass some of the dreary hours by playing "whist," the losers having to cook the supper.

Very early in the morning of the 18th we turned out, ex-

tricated our sledges and dogs from the snow-drift, had breakfast, and got started again by 9 o'clock. The morning was fine but intensely cold (60° below freezing point), and the dogs travelled well. At 2 o'clock we made a halt, fed the dogs with seal flesh, and partook of some biscuits ourselves. In taking a nip of port wine from an aluminium

SLEDGING IN THE ANTARCTIC.

flask, I inadvertently put the bare nozzle to my lips, where it immediately stuck fast and brought the skin away with it. The lips and tongue bled for some time, and stung for days afterwards. Towards evening a gale sprung up ahead quite suddenly, and, although we put on our wind clothes and attempted to battle against it, we were forced to stop through the dogs declining to go further by obstinately lay-

ing down—a thing they invariably did when a gale arose. So we formed a square with the sledges, pitched our tent in the centre, and lay shivering inside until the storm passed, which it did in a few hours' time. Then we continued the journey, and at midnight got close in under the opposite shore.

When we finally pitched camp for the night on some very rough ice the temperature had sunk to nearly 70° below freezing point, and it felt bitterly cold.

There was very little sleep to be had in such a temperature, and the spiky surface of the ice communicated a sensation to our backs similar to that Micromegas experienced when he lay at full length upon the Alps.

CHAPTER VII.

"The drifted snow to dust the travellers beat,
The uneven ice is flint beneath their feet.
* * * * *
Borne without wheels, a flight of rival cars
Track the ice-firmament, like shooting stars."

—J. MONTGOMERY.

NOTWITHSTANDING twenty-two hours of almost constant toil and exposure which, under most circumstances, would have conduced to sound slumber, all were glad to turn out again in a few hours and caper about on the ice, slap each other on the backs, and swing their arms around like the sails of a windmill, in order to coax a little warmth into their frozen bodies.

The temperature had sunk to -35° Fahr. (67° below freezing point) and lying as we did upon rough ice, utterly devoid of any snow covering, the cold had asserted itself pitilessly, creeping through every crevice of our clothing, freezing the soles of our feet to the bottom of the sleeping bags, freezing the hair of our faces to the hair of the bags, and rendering everyone completely and utterably miserable.

There was some compensation, however, in the gloriously fine morning. The sun, as we emerged from our tiny tent, was just rising, and the sky was a blaze of scarlet and orange from the dazzling gold of the horizon to the softest and lightest pink near the zenith. Precipitous walls of ice sur-

rounded us on nearly every side, which glimmered and sparkled all over where the rays of the rising sun fell upon the thousand facets of ice. Beyond these walls Mount Sabine looked down upon us from the lofty majesty of its 12,000 feet the top girdled by a single zone of richly coloured cloud.

It is hard to convey a faint idea of the ineffable grandeur of the view which extended around us and the stillness and solemnity of it all.

The walls of ice puzzled us considerably and it was not until we had climbed to the summit of one of these barriers and were able to get a view of our surroundings, that we discovered we had steered a wrong course the previous night and, in the darkness, had run into a kind of inlet between two huge tongues of ice five or six miles further down the coast—a veritable *cul-de-sac*.

These tongues of ice, which were the seaward prolongation of two great rivers of compact crystalline ice creeping down from the deep mantle of snow and ice enveloping that polar land, extended out into the bay for a distance of three miles, and were, perhaps, half a mile broad.

Two glaciers traversing convergent valleys united at a point about six miles above these tongues, and the lateral moraine stuff, which could be easily traced on one side of each, coalesced and formed a broad and conspicuous medial moraine down the centre; much of the moraine rubbish, however, was concealed by the loose snow on the surface.

A very large dark boulder was observed at a point near the extremity of one of the tongues of ice, which no doubt will ultimately be carried away on one of the great table-bergs to which these glaciers give birth, and dropped far north into the bed of the Atlantic Ocean.

We measured the height of the ice ramparts in several places by carefully marking out a base line on the frozen surface of the sea and observing the angles of elevation with the sextant; the average height was about 90 feet. Of course, the icebergs formed in Robertson Bay do not attain anything like the dimensions of those drifting up from farther south where the glaciation is so much greater.

On the lee side of the ice tongues, great piles of snow-drift were accumulated by the east-south-east gales and heaped up almost on a level with the summit of the wall. At some places, great sinuous blue cracks extended far backwards, the deep azure blue colour being caused by the blue rays of the solar light being reflected, whilst all other rays are absorbed.

The sea ice around the extremities of the tongues was very little cracked or crushed together, proving that the movement of the glaciers was not, at that time of the year, very considerable.

The glaciers of the Antarctic do not, I think, move rapidly at any time of the year. In this respect these are very different to those of Greenland, some of which are the most rapid moving glaciers on the surface of the globe. No actual measurements on the rate of motion of Antarctic glaciers have been made, so that nothing positive respecting them can be advanced. Sharp detonations, however, were frequently heard, showing that there was some movement going on in the mass.

We ate our breakfast with good appetites, although everything excepting the cocoa was frozen hard; then with all possible alacrity we struck camp and continued our march. The dogs that morning were considerably below par; they had pulled hard the day before and must also have suffered from

THE COAST LINE IN ROBERTSON BAY.

the severe cold, for they had to sleep on the bare surface of ice devoid of snow covering; in addition to this they had no food.

We had to retrace our steps of the previous night for about three miles, then, swinging round the extremity of one of the ice-tongues and continuing along the shore, we reached the small islet, our destination, late in the afternoon, pitched tent and were soon happy around our Primus stove, which, under the fostering care of Mr. Evans, was soon busily cooking some seal steak freshly cut from a seal found and killed near a lane of open water. This lane was teeming with seals; innumerable black heads of these graceful sleek creatures bobbed up here and there like so many corks, while some would raise themselves half out of the water to gaze at us with their soft brown eyes.

It was my painful task to slaughter one—which we were compelled to do—not so much for our own purpose but for dogs' food. As I approached the doomed animal, it lifted its wise grave face and regarded me with the dignity of a sea-god and I felt but little inclined to slay such a rational-looking creature. But when needs must, etc.,—so, as it lay on its back quietly gazing up into the tranquil heavens and quite unprotected, I walked quickly up to its side and, watching my opportunity, plunged the long bowie knife which I carried through its breast and into its heart.

The half-starved dogs fell upon the flesh like a pack of famished wolves, and it was difficult to ensure the weaker ones their full share in the scramble for supper. In truth, we fell to upon the steak and steaming hot soup with no less gusto, for we had been without food since the meagre breakfast partaken in the morning.

The next few days we were favoured with an unprecedented spell of bad weather; a gale blew with scarcely any intermission for five days. The temperature rose to a few degrees below zero, so that at night we did not suffer from intense cold; but the continually drifting snow was no less uncomfortable, and almost filled the tent and penetrated into our sleeping-bags and clothes. Day by day, more snow and ice accumulated and became a source of great inconvenience.

Still, notwithstanding the adverse elements, we were able to do a little exploring, and collecting of geological specimens; but the erection of a stone hut, the chief purpose of the journey, was quite impossible even if the weather had been less inclement, for, in the first place, there were too few detached stones available.

Everyone, however, was quite cheerful and contented, and enjoyed the "*picnic*" immensely. At night, over a warm supper, all were happy and even hilarious, despite the gale that howled outside and tore savagely at our frail silk shelter.

After the dogs had been fed on seal flesh, the opening of the tent blocked up, and foot-gear changed, pipes were lighted and yarns passed around; stories of adventures that had befallen us in Canada, Australia, Norway and numerous other parts of the globe. The stories I have forgotten. I strongly suspect they were not true, but, at any rate, they were not dull; such constant practice rendered us indulgent and perhaps even credulous in the matter of "snake stories" and autobiographies. Then, when diaries had been written up (always a painful business), watches wound up, and barometer examined, we wriggled into our frozen bags to sleep, or if not to sleep to shiver.

The spot upon which we were camped was a small islet, which has been named Duke of York's Island, perhaps three miles in circumference, and surrounded by a glacier, which nearly conceals its insularity.

The geological formation consists of a greenish slatey rock of a very fissile structure which is, on the whole, intensely crumpled and plicated. Crystals of pyrites occur disseminated throughout the formation, in some places in great abundance. The pyrites appeared in small cubical, perfectly opaque crystals, which, with reflected light, showed the characteristic brassy lustre of the mineral.

These crystals appeared to yield but slowly to weathering, for generally the cubical crystal could be seen projecting still fresh from the stone, which had, no doubt, been long exposed to the atmosphere, and a small blow would, in many cases, loosen the entire crystal from the rock.

The formation was here and there traversed by thick veins and narrow threads of quartz, showing strong evidence of disturbance, and seemed to have been exposed to a powerful lateral pressure; this quartz contained bluish and rusty-coloured streaks. In the crevices of the slate-rock, a dark, soft, soapy substance, something like graphite, was found.

In some places, the stratification formed roads on the side of the mountain some 30 or 40 feet in width; in other places, the greenish colour of the formation was changed to a dull brick-red, as if it had been under the influence of heat. Whether this is really caused by heat or is merely the effect of weathering I do not know, probably the latter cause is correct. These red patches were conspicuous some miles away, and were exactly similar to the formation around them, and relatively, in no way disturbed.

The slatey formation extended as far north along the coast as we examined, which was about five miles; the general inclination of the stratification being about 60° and dipping south. It would have been interesting from a geological point to have followed the formation round towards Yule Bay and Cape North.

At a place about two miles south of the islet and right in the bottom end of Robertson Bay, a dark eruptive rock of very great density and very hard flowed over the sedimentary formation, and thus completely hid from view its southern prolongation. It probably continues underneath the lava-flows towards Mount Erebus. At Wood Bay it may be found outcropping again on the surface. This sedimentary formation is of immense interest; it appears to continue north, towards Wilkes Land, for Dumont D'Urville found slate rock at the place where he landed in the neighbourhood of "Pointe Géologie," and it possibly underlies most of the volcanic rock of the Antarctic Land. This slate formation also appears among the islands south of Cape Horn.

The geology of the Antarctic is a subject replete with interest, for nowhere else does fire and frost divide the sway so completely. In the extensive sedimentary deposits fossils might be found and the indications of a warmer climate during some former epoch.

One afternoon we climbed to the summit of a neighbouring peak nearly 2,000 feet high, and obtained a charming vista of the surrounding peaks. Mount Sabine, capped with a heavy mass of cumulo-nimbus cloud, looked especially fine and impossing. Mountaineering in the Antarctic regions in a temperature of −20° F. is not a task to be envied; one wants

THE SLATE FORMATION IN ROBERTSON BAY.

to be in good condition and not wheezy of breath. The result, however, amply repays one for the expenditure of energy. Nearly all in camp were admirable mountain scramblers, but, unfortunately, none were experienced in the craft of mountain climbing.

We sat for some time on the mountain top, gazing over the stupendous glaciers below and following their meandering courses away into the interior. At last, the piercing cold compelled a retreat.

In descending we were able to *glissade* down considerable slopes. I was not, however, altogether in love with a *glissade* down those steep hard snow slopes; the snow was too compact and hard to force a steering-spike into, and after the first 100 feet you gained such momentum that the *glissade* became a fall, and you ultimately found yourself bouncing about among the rocks at the foot of the slope, perhaps 500 feet below the spot from whence you started.

On August 26th, the weather having moderated sufficiently, Ellifsen and I set out with two sledges and two teams of dogs for the huts at Cape Adare. We covered the distance (22 miles) in eight hours and fifteen minutes—a record time, only beaten some weeks afterwards by Mr. Borchgrevink.

The next day was very fine; not a wisp of a cloud in the sky, and a brilliant sunshine flowed over the land. It was aggravating to think that we should not have been favoured with such a day during our trip, so as, at least, to enable us to get some photographs, and that immediately on returning, after having experienced twelve days of boisterous weather, it should suddenly become fine.

As far as I was personally concerned, the result of the journey was highly satisfactory, for on weighing myself,

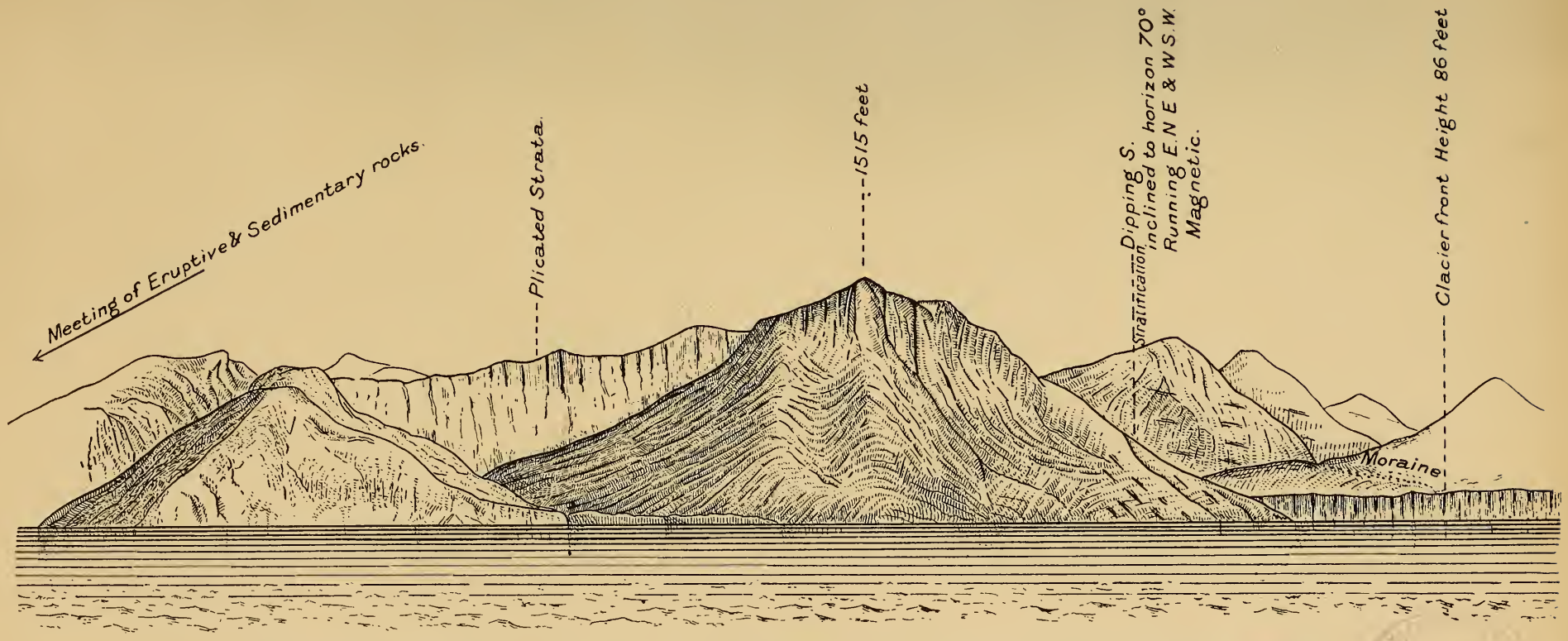
immediately after the return, I found that I had gained three pounds !

A few days after my return, the Commander set out with six companions and five heavily-laden sledges for the islet at the bottom of the bay, ostensibly for the purpose of attempting to penetrate across the mountain range into the interior.

Towards the end of August the heat of the sun, when the sky was clear, became very appreciable. On the 29th, a small and very sensitive ordinary thermometer, of which the bulb had been blackened with indian ink, indicated +26° Fahr. in the sun at noon, whilst the temperature in the shade at the same time was −17°Fahr. Patches of open water to the north were indicated by a very well-defined water-sky. On the 16th August this open water nearly reached Cape Adare ; this was during the only gale we experienced from a northerly direction, and which blew for only a few hours. It is evident, then, that the Ross Sea does not freeze in the winter beyond a distance of some 40 or 50 miles from the land.

During the night of the 31st August, Hanson, Ellifsen and I narrowly escaped death by suffocation. We had retired to our bunks as usual, at about 11 p.m., leaving some burning coals in the stove.

In the early hours of the morning, I was awakened by Hanson calling me by name ; I turned out at once, but had no sooner stepped upon the floor than the room commenced to swing round, and my vision grow dim. *There was no air in the room.* It dawned upon me in a dreamy kind of manner that we were being asphyxiated by fumes from the coals in the stove, and with a great effort I staggered over to the door and threw it open, and then fell across the table unconscious, for I remembered no more until I felt someone putting a cup



SKETCH OF LOCALITY IN SOUTH END OF ROBERTSON BAY, WHERE SLATE FORMATION BEGINS.

to my lips containing spirits, which I gulped down. Ellifsen was standing over me with a white, drawn face, and looking as if he was about to fall; he had had the same experience. The noise made by the opening of the door and the cold draught had awakened him, and he had turned out of his bunk. Feeling himself going off, he had rushed out into the open air, where he soon revived. Hanson was in a terrible state and, although we did everything to relieve him, he vomited for over an hour. He must have been in great agony for the perspiration stood in great drops over his face; at times he was so bad as to completely lose consciousness, and we thought he was dying. Gradually he got better, and finally went off to sleep.

Ellifsen and I now investigated the cause of all the trouble. We found that the wind, having changed in direction during the night, had blown down the flue of the stove and filled the room with fumes from the red-hot coals. These fumes had no way of escape; the hut being especially built to keep out cold, every crack and hole was closed.

Next morning Ellifsen and I were in a very bad way, suffering all day from a sensation of nausea and excruciating headache, but Hanson, strange to say, was quite well, nor for some time afterwards did he appear to have suffered any ill effects; from the day of this accident until the first two or three days in October, a period of more than thirty days, he was able to take nutriment just as he had always done.

I must mention here that although Hanson was an invalid and confined to his bunk for many long weeks, he never suffered in any way from melancholy. On the contrary, he was the most cheerful of the party, and frequently enlivened us by

telling of his experiences in the mountains and among the *sietas* of his beloved Norway.

On September 9th, accompanied by Ellifsen, I again set out on a short sledge journey. A message had been received from the Commander with instructions to bring up more provisions.

To turn out at five o'clock in the morning, in the expectancy of making an early start, and ultimately get away at noon, is aggravating in the extreme.

We had hoped to start at six a.m., having prepared the sledges the night before, and fastened up our dogs, but, alas! we had not examined the harness, most of which we discovered next morning to be missing, and the remainder in a dilapidated condition.

Although this incident considerably ruffled our tempers, it was, on the whole, a fortunate occurrence—preventing, as it did, our attempting to travel right through to our destination in a day. We had three sledges and eighteen dogs. Two sledges contained provisions and personal apparel, and the third a collapsible boat.

On starting, the weather was not promising. The barometer indicated 28.5 inches, and was falling rapidly. Another gale of determined character was imminent. Great globular masses of snow rolled lazily along the top of the Cape, and whirlwinds of it were visible gyrating out along the ice to the north. It was unwise to start at all under such threatening conditions.

But we had delayed long enough, and we were confident of reaching the shelter of the iceberg, our usual intermediate camping spot, before the storm commenced. Mr. Evans accompanied us part of the way over the roughest ice. He

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kept with us for about an hour, during which time a pocket aneroid I had with me fell two-tenths of an inch. Being lightly clad, Evans thought it advisable to return before the gale overtook him. Kolbein and I pushed on at a snail's pace. The dogs were either fatigued or lazy, and we were forced to pull the sledges ourselves. Having three loaded sledges which continually toppled over when rough ice was encountered, our difficulty can be imagined. After five hours of toiling, we reached the berg and got under its lee, just as the expected gale broke upon us.

That gale, and the horror of the subsequent night, I shall never forget. It will rattle and rage in memory for evermore. Luckily we managed to pitch tent, feed dogs, and partake of some food ourselves before it became violent. The barometer had been falling swiftly all afternoon. At 5 p.m., when we reached the berg, it was 28.2 in., and at 7 p.m., when the gale was already raging furiously, it was 28.1 in. At 9 p.m. it had fallen to 27.9 in.

We turned in, but not to sleep. The hoarse roaring of the wind, the flapping of the small silk tent, the snowdrift lashing its sides, and the straining of the ice underneath us, did not invite it. Hour after hour the gale blew with appalling violence. At midnight I thought it advisable to keep a watch, for, remembering the open sea to the north and north-west of us, and the celerity with which the ice in the bay had broken up in May, when we had narrowly escaped with our lives, there was every possibility of it doing so now, and obviously the first place to go would be immediately around the walls of the iceberg, in which event we would be precipitated into the sea. I therefore told Kolbein to take the first watch of two hours, and to arouse me a little before 2 a.m.

It was a night of horror. I lay shivering in my wind clothes on top of the sleeping bags in the tent, which, by this time, was half choked with drift snow. The barometer still continued to fall, and the gale increased in force proportionately.

At 1 a.m. the aneroid registered 27.86 in. I think few can say that they have seen so low a barometric pressure at the sea level, even in a cyclone of the tropical zones, or during the dreaded typhoon of the China Seas.

The cracking and groaning of the ice-pack ever increased, and I now thought it high time to get outside and endeavour to find a place of refuge on the iceberg itself, in the event of the pack suddenly breaking up. It must be remembered that the ice upon which we were camped was only 1 ft. 6 in. in thickness, and was formed of small angular blocks cemented together by the frozen sea water. Again, the breaking up of a pack during a gale is so rapid, for we have seen openings appear and travel along just as black squalls of wind, that one has absolutely no time to do anything—not even to walk a dozen yards. Outside all was black obscurity, one could not see the precipitous walls of the berg even when striking it with the hand. Peering into the darkness towards the west we imagined we could see a dark blink in the sky resembling open water; moreover, the cracking of the ice in that direction was perceptible above the roar of the wind.

I remembered that a little to the east of us, in the side of the iceberg, was a large cave, which, if we could attain, would ensure us safety for the time being from the sea. We therefore tried to get to it by groping our way round the slippery walls of the berg. We moved along blindly, both hands placed on the lofty crystal wall and our bodies bent in close

to it. We had only proceeded halfway when, having to go round a small prominence, we were suddenly exposed to the full impetus of the wind. It struck us like a solid thing, bearing us down before it. The temperature was about −9° Fahr. (41° below freezing point). Facing such a wind at such a temperature was out of the question; we should quickly have been *in extremis*. We were, therefore compelled to retreat and attempt the west side.

At last, after feeling our way round for half an hour, we discovered a low part of the berg upon which we scrambled, and here remained until daylight. The place was fairly well sheltered from the wind, but great masses of drift-snow accumulated about us. The cold was intense. The temperature and wind rapidly dissolved the little heat we had gathered in reaching the spot, and we now commenced to crystallise. So in order to get warm we lay down on the surface of the iceberg, and were soon covered over with snow.

We lay there for nearly four hours, buried in the snow, and the storm howling around us at a temperature of nearly 10° below zero (42° below freezing point). We fell into quite a comatose state, and only with a great effort managed to rouse one another alternately. To fall asleep would undoubtedly have been dangerous. At last day broke; the wind had considerably abated, although the barometer still remained below 28 inches, and we returned to our tents without fear, for we could see no open water near us. Our garments were frozen as stiff as boards, and we had lost all sensation in the knees, beards were solid lumps of ice, and we were covered from head to foot with snow; however, we lost no time in crawling into our reindeer sleeping bags, and were soon sound asleep, and slept on until after mid-day.

I awoke at about 2 p.m., when we turned out of our bags and made ourselves some coffee and partook of some food. It was still blowing fresh, but the sky was clearing and the barometer rising, and we hoped to be able to proceed on our journey in the morning. As soon as we had satisfied our hunger, we again made for our bags and slept on until six o'clock next morning. We were disturbed once during the night by a miserable dog, which was strangling itself from the harness having wound round and round its neck in an almost inextricable manner. The poor beast was making a most piteous noise, and I had to turn out and release it. I think I must have been quite half an hour tugging at the frozen leather straps bound round and round its neck, and this in a temperature of 52° degrees below freezing point was an execrable task.

It was eleven o'clock before we were able to make a start. Our three sledges were completely buried under the snow, the boat full of it and required emptying, and the dog harness was entangled in the most bewildering manner. I had contemplated leaving one sledge behind, but at the last moment decided to take the three, not caring to be beaten.

We travelled with all the speed we were capable of, and stuck to it grimly hour after hour without stoppage. The first few hours over some chaotic masses of ice was heavy work; our shoulders were sore with pulling at the ropes. It was a fine, clear day, and the bright sunshine, reflecting from the white flats around us, was rather painful to the eyes. The barometer was falling, and then wisps of cirrus clouds moved across the sky from north-west to south-east. I thought we were in for another gale, but was mistaken.

Towards evening we encountered smooth ice, and here the

sledges ran smoothly enough, but the dogs were weary and required much urging. Across the smooth ice we saw many cracks, some a foot or more in width, and extending across the Bay as far as one could see. I was surprised at the thickness of the ice; it was no more than eighteen inches, whereas I had believed it to be some four or five feet. At 7 o'clock it was dark, but the moon and stars shone forth in unclouded effulgence, and illuminated the desolate, unspeakably desolate, landscape. Nothing broke the silence around us but the scratching of the sledges and the patter of the dogs' feet on the ice. It was a gloriously fine night; the perfect tranquillity reigning over all was deeply impressive, and when we approached close to the land, the moonlight effect on the great glaciers, on the walls of ice, and on the pinnacles and million irregularities, was most sublime; but by this time our minds had become dulled to beauty and had sunk into the heaviness of our feet. We reached the camp at eight o'clock, fatigued and ill-tempered.

On arriving, the scene presented to us of our companions would, under other conditions of humour, have been intensely amusing. If a modern Doctor Syntax had been in search of the ludicrous instead of the picturesque, he would assuredly have found it there. For in truth the scene was singularly funny. Picture a crude hut built of slabs of stone, of sledges, and of tents; in one corner a roaring furnace of seal grease, and seated around, gravely regarding the fire with expressions that would grace a mute at a funeral, a group of explorers of so fuliginous and oily an appearance as to absolutely defy identification, a perfect sonata in sombre tints, all smoking and blinking in blank contentment.

I fear we did not, at the time, fully appreciate this tableau,

so grotesquely sooty, for somehow our advent acted like an explosive bomb, and quite broke up the quaint and happy circle.

On the following morning I was instructed to remain another day in order to take some photographs of the glaciers. We went forth equipped with camera and various other things towards the opposite side of a glacier, which has been named after Sir John Murray.

At the place where we crossed it was about five miles broad, and although, at this particular spot, its surface was not irregular, it contained a maze of crevasses hidden by the crust of hard snow, and required to be carefully negotiated. Indeed, we had many narrow escapes. The Commander and the Doctor in advance had a rope between them, but Colbeck and I were without any. We would walk along confidently upon what looked to be the firm surface of the glacier, when suddenly, without a moment's warning and with a rapidity to take one's breath away, down one or the other would go, and only saved from disappearing altogether by the timely assistance of the other. When hauled out of the hole made by the feet, a deep transparent crevass of opaline blue and green yawned beneath like a hiatus leading to a sinister and unknown world which, you may be sure, we were in no haste to prematurely investigate. Speaking of crevasses. A few days before one of the Finns had come nigh losing his life in one of them. He was walking alone on the glacier not far distant from the camp, when all at once down he went ; he endeavoured to save himself, but it was too late, and away he shot down, down, into the abyssmal depths below. As he fell he turned over and went head foremost. The exact moment of touching bottom he appears to be rather hazy

about. When at last his reason returned he knew not at first where he was, but finding that he was sandwiched between two walls of ice, perceiving far above him a thin streak of light, and feeling an intense pain in his head, it dawned upon him that he had fallen into a crevass, and was, as he thought, somewhere down in the bowels of the earth. Then, mad with terror, he commenced shrieking for help, and kept this up for more than an hour until his voice forsook him, and he could no longer whisper. He could hear someone cutting up the frozen carcase of a seal for the dogs, but knew that he was unheard. His state of mind can be imagined. At this stage his hand accidentally came in contact with a clasp knife in his pocket, and only then it flashed upon him that he might do something for himself; so placing his back against one wall of the crevass, and cutting small steps for his toes with the knife in the opposite wall, he succeeded, after an hour's hard work, in attaining to the surface again, and got back to camp half frozen and in a complete state of collapse.

We succeeded in climbing up the glacier for a distance of about five miles, when all further progress was stopped by the broken up and crevassed nature of the glacier and the steep precipitous nature of the mountain side.

On the following day (September 13th) Ellifsen and I returned to Cape Adare. The gale during the night of the 9th was the heaviest experienced at the camp. Showers of stones had rattled on the huts all night, and the velocity of the wind rose above 100 miles an hour. The mercury barometer reached the lowest reading ever observed within the Antarctic Circle, viz., 27.913 inches.

The highest barometric reading observed at Cape Adare was 30.156 inches, which occurred on July 22nd. So that

the extreme range between maximum and minimum is 2.243 inches.

The weather during the first week of October was fine, with few storms; bright, sunny, halcyon days, but cold, very cold; the temperature remaining obstinately low, the mean for four successive days being under $-20°$ Fahr.

The clear weather however was very favourable for taking some good photographs.

The days grew longer and longer. At midnight a streak of light from the sun, only a few degrees below the horizon, was visible in the south. The aurora was now no longer visible on account of the large amount of daylight.

At this time (October 4th) the illness of our companion, Mr. Nicolai Hanson, took rather a grave turn. He was absolutely unable to retain any food, and, as a consequence, became weaker and weaker.

CHAPTER VIII.

"So when that Angel of the darker Drink
At last shall find you by the river-brink,
And, offering his Cup, invite your Soul
Forth to your lips to quaff—you shall not shrink."

—OMAR KHAYYAM.

AND now there came upon us a period of most poignant grief and sadness, for on October 14th one of the noblest and best of men, Nicolai Hanson, passed away. His death, so grand and so calm, was surrounded by most pathetic scenes. Although he had been ill for many months the end was sudden and unexpected, and was a great shock to us, to whom he had endeared himself.

Early in the morning of the 13th we all moved out of the hut, pitched a tent outside, and lived there. This was to enable the invalid to have better air and the doctor more room. The latter was indefatigable in his attentions to the end, but alas! all to no avail. Every attempt to give him nourishment was unsuccessful. At two o'clock in the morning of the 14th, whilst we were all slumbering in our bags in the tent, Mr. Fougner, who assisted the Doctor during the last day of the illness, awoke us with the startling information that

our companion was dying, and that he would like to see us and shake hands with us before he died. Our feelings can be imagined at receiving this news. That he, whom we all admired, who had never injured any one of us either by word or deed, the most unselfish of men, who had been a constant and cheerful comrade for many dreary months, a man in the dawn of life, and only married a few short months before leaving home, should be about to die, seemed a dreadful anomaly.

We all went into the hut. Hanson was lying in his bunk in a very weak and exhausted condition. The Doctor was seated alongside him, and said as we entered, "I have told Mr. Hanson that he cannot stand this illness much longer, he would therefore like to say a few words and shake hands with you all."

Then followed a most harrowing scene, upon which it is painful to dwell. He seemed to contemplate death with utmost calm and resignation, and quietly shook hands with us all, asking to be remembered to those on board the *Southern Cross.*

His zoological work seemed to absorb much of his thoughts, for he gave instructions on various matters in connection therewith, and handed over his note-books to the commander. Then he asked where we intended to bury him.

"Wherever you wish," he was told.

"Well, you remember me being photographed nearly a year ago, standing by a large boulder on the summit of Cape Adare? I should like to be interred on the leeside of that stone." This was promised. It was a never-to-be-forgotten scene. Soon afterwards we all went out; the next time we

beheld him the hand that had so warmly grasped ours was stiff and cold.

The Doctor and Mr. Fougner were now left alone with him, and he gave them his last messages for those at home. He endeavoured to write to his young wife, but was too weak and only succeeded in addressing an envelope, in which he requested his marriage ring should be placed (the Norwegian husband wears a ring as well as the wife).

The hours passed slowly by. We roamed about outside in a desultory manner, anxious for the slightest news which might convey a ray of hope; but there was none. Shortly after three o'clock in the afternoon that grand and heroic soul had departed.

The Doctor was with him during the last moments. Strange to say, he retained all his mental faculties until the end. In the forenoon he had suddenly turned to those in the room, and facetiously remarked: "What would you say now, boys, if I were to get up and walk outside?" And just prior to his death he calmly remarked, "It is not so hard to die in a strange land; you are saved the sight of sorrowful relatives, and it is only like saying 'Good-bye' to one's friends when starting on a long journey." A few minutes afterwards he had breathed his last; thus he passed away into the Great Mystery, like the brave and true-hearted Viking that he was.

That evening a great storm arose and blew all through the night and all the following day, so we were compelled to remain indoors. I was commissioned, with the two Finns, to dig a grave for the body, and on the morning of the 16th we proceeded to the spot on the top

THE LATE MR. NICOLAI HANSON.

of Cape Adare and measured out the ground on the north side of the rock.

The hard frozen surface was like iron, and after working all day we only succeeded in excavating to a depth of about four inches. It was a Herculean task; the surface was a conglomerate of small stones frozen together, and was as hard as solid rock. We broke all our implements in trying to remove it. On the next day we brought up a large quantity of dynamite, and, by its aid, we were more successful.

After having sunk to a depth of about 1 ft. 6 in. we struck a body of solid ice, no doubt part of an ancient glacier, over which, during the course of centuries, masses of stone and rubbish had accumulated, swept down by the winds from a higher level. The rest was comparatively easy, and on the next day, October 18th, we completed it to a depth of over five feet, four feet being through solid ice. On October 20th the body was interred.

It was placed in a wooden coffin, wrapped in the ample folds of the Norwegian flag. Hauling it up on a sledge to the summit of the Cape was a difficult task, but at last it was accomplished. At the grave a short service was read, and the two Finns, who were deeply attached to the deceased, chanted a hymn in their own quaint language, which was most pathetic, coming as it did straight from their hearts. A few dried flowers and ferns were placed in the grave—sad souvenirs of our homes so far away.

It was an ideal burying place upon the top of that desolate and almost unknown Antarctic Land; the body encased in ice, so that centuries hence it will present the same aspect as it has to-day. An "erratic" boulder, which had, perhaps, wandered from the heart of that ice-clad country, marks his

last rest. There amidst profound silence and peace, there is nothing to disturb that eternal sleep except the flight of sea-birds. In the long dark winter night, the brilliant and mysterious *Aurora Polaris* sweeps across the sky and forms a glorious arc of light over the Cape and the grave. In the summer the dazzling sunlight shines perpetually upon it.

It seemed a strange fiat of fate that one born and bred at one extremity of the world should come to the other extremity to die.

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The first two or three penguins (*Pygoscelis Adeliæ*) made their appearance on the day of the death of the zoologist, and for about three weeks they continued to arrive in tens of thousands and accumulated on the summit of the Cape; on its western side and on the strip of pebbly beach we lived upon. They came from the north, walking across the ice in regiments like soldiers.

An exhaustive account of the Antarctic penguin, about which little is known, for they generally keep within the Antarctic Circle, and have their rookeries on the Antarctic shores, could almost fill a volume. Here, we can only give a very brief description of them, and will classify it under three heads: *Their general appearance; Method of congregating and travelling in the breeding season; and their general habits.*

Penguins belong to the order Impennes.

They are chiefly remarkable for their close-set plumage, unlike that of any other birds, and the flipper-like character of their wings. The feathers, which are hard and scaly, are distributed over the whole body, so that there are no bare spaces between the feather tracts as in most birds. They

generally walk or hop in an erect position, and they are assisted in the support of their heavy bodies by the unusual strength of their tarsi, the metatarsal bone being very short and wide. The three front toes are of moderate length, and completely webbed, whilst the first toe is very small and united to the sides of the metatarsas.

THE LONELY GRAVE ON THE SUMMIT OF VICTORIA LAND.

It is believed that the penguins have some affinity to the diving birds, yet the structure of the metatarsas seems to point to their being an extremely primitive type. This view is supported by the large number of rudimentary wing-feathers, and likewise by the circumstance that remains of a very large penguin having been obtained in New Zealand from strata of Eocene Age — thus showing the extreme antiquity of the group.

The *Pygoscelis Adeliæ* average about 29 inches in length, length of flippers 8½ inches, and length of beak a little over one inch.

This short beak is straight, deep and compressed, and the tip sharply pointed, and the upper mandible is slightly hooked. The colour of the beak is black on the upper and bottom parts, and brown towards the edges.

In colour, the plumage of the back is black with a slatey-coloured medial streak down the feathers; the under parts are dazzling white; the head is black and a broad band of the same hue occupies the upper part of the throat, which joins directly with the dark area of the head.

But the most conspicuous thing is the jet black eye set in an immaculate white circle, which gives them a quaint and certain forbidding aspect.

The Emperor Penguin (*Aptenodytes Forsteri*), which is a solitary bird and of which we procured only a few specimens, is much larger, being on an average about 44 inches in height, and sometimes over 4 feet, the flipper nearly 14 inches in length, and the beak, which is hooked, about 4 inches. The breast has a light yellow tint passing into deep yellow on the sides of the head. This bird must not be confused with the King penguin (*Aptenodytes Patagonica*), which is a somewhat smaller species, although very similar in appearance, and is found on the small islands just outside the Antarctic Circle.

The arrival of the small penguins at Cape Adare presented a most curious appearance. When walking on the rough ice, they struttle along upright, but as soon as they reach ice upon which there is some snow, they drop down on their breasts and glide along toboggan fashion, making use of

PENGUINS ARRIVING.

flippers as well as feet. They all travelled along the same path, which soon became bloodstained from their bleeding feet, cut by the projecting pieces of ice.

They came from the north and must have travelled at least twelve miles over very rough ice. Some landed upon the pebbly shore at Cape Adare and nearly all at the same spot, but others continued to journey southwards towards the bottom of Robertson Bay, where there was another rookery. It was like an immense army. For fourteen days they came in an absolute unbroken continuation.

One day we witnessed the black meandering line of penguins from the summit of Cape Adare, and could trace it for quite two miles out towards the northern horizon.

They did not in the least hurry themselves, but trudged along steadily in their own phlegmatic way. Their pace was, perhaps, one mile an hour. When approached by anyone, they stop and make no attempt to get out of the way, but they shorten their necks and lower their beaks until they assume the appearance of looking down their noses; then, they slowly stretch their necks and raise their beaks until they point upwards towards the sky, making at the same time a droll raucous cry; all this with a most ludicrous aspect of indignation, as no doubt they were—profoundly indignant.

Sometimes, one or more of the most audacious would rush out from among their companions and attack you furiously: on presenting the sole of the foot, booted of course, they peck at it viciously and with such vigor as to leave marks upon the hard frozen leather. They do not give way an inch of ground, but stand up before you erect and determined.

As to their general habits.

On landing, they make straight for a certain spot; some, to the summit of the Cape, up the snow slope of which they climb with great facility, some, to the base of the mountain, and others scattered over the shore.

They congregate together in communities or social coteries of fifty and upwards. On reaching the spot they immediately start to build their nests, in which work the male as well as the female participates.

The nests are crude affairs; the first operation consists of scratching a small depression in the old guano, then pebbles are carried to it in their bills and piled around, and as soon as it is completed, which takes a day or so, the female sits in it and the male commences his courtship. It was highly amusing to watch their love antics.

Some are industrious and pile around many hundreds of small pebbles, others—the lazy ones—were quite proud and delighted with only half-a-dozen. On approaching the former nests, the occupants generally modestly retreated before the intruder, but on approaching the latter—the lazy ones with absolutely nothing to boast about—they made an enormous fuss and rushed at you to bluff you away with their own prowess!

It was laughable to watch how they pilfered stones from each other's nests; they are most shameless thieves. The thief slowly approaches the one he wishes to rob with a most creditable air of nonchalance and disinterestedness, and if, on getting close the other looks at him suspiciously, he will immediately gaze around most childlike and bland, and appear to be admiring the scenery. The assumption of innocence is perfect; but no sooner does the other look in a different direction, than he will dart down upon one of

THE PENGUIN ROOKERY AT CAPE ADARE.

the pebbles of its nest and scamper away with it in his beak as fast as his little short legs will bear his fat body. If the theft is discovered, the injured party will give chase; then all the kind and sympathetic neighbours rush in and rob to their hearts' desire!

Woe to the foolish penguin that rambles about in a restless fashion among the community; before making his escape outside the circle, he will have left behind a large quantity of his plumage, with which the others will feather their nests; he must either have a home, *i.e.*, a nest, or keep quiet on the outside of the circle if he wishes to be left alone; that is a *sine qua non* among them.

The females generally fought whilst sitting in the nest by stretching out their necks and pecking at each other's tongues; but the males fought in the orthodox and picturesque human fashion, with their arms, that is to say, their flippers and their teeth, that is to say, their beaks.

The pugilists stand erect and deal each other resounding blows with their flippers, first one and then the other with astonishing rapidity.

When one is knocked down, the beak of his opponent is brought into play with no slight effect. The females rise from their nests and try to intervene and separate them, repeatedly getting between the combatants, and moving their heads rapidly from side to side in protestation.

I have seen the females drive the least attractive fighter right out of the circle, but, quite unabashed, he would at once rush back to his antagonist, and the fray would commence again.

These fights lasted as long as a quarter of an hour, in fact, they were not terminated until one was completely vanquished.

The vanquished bird generally presented a pitiful appearance, being covered with gore and devoid of much of his plumage, and it took him some days to recover his equilibrium. The din that those thousands of penguins made was deafening, and was like the roar of a vast multitude of people.

The Antarctic skua gull (*Megalestris Maccormicki*) arrived on the same day as the penguins, singly at first; a few days after in great numbers. They are of a light brown colour and measure nearly five feet from tip to tip of the wings. Being of a most predatory nature, they played great havoc among the eggs and young of the penguin. Indeed, they may be said to live entirely upon them during the breeding season, for, wherever there are penguins the skua gulls are not far away.

On November the 2nd the penguins commenced to lay their eggs. Two is the number laid, and an interval of three days elapses between the laying of the first and second egg. They are white, and average from two to more than three inches in length, and from one and a half to two inches in breadth; some are almost spherical in shape. The shell is thick, and the inside has a greenish tint; the yolk is comparatively small, the contents of the shell being mostly albumen.

We collected some 4,000 of these eggs for dietary purposes and packed them in salt. They were a luxurious addition to our larder; being utterly devoid of any strong flavour they were greatly relished.

The poor penguins, when robbed, looked extremely disconsolate; however, there was some consolation to be derived from the fact that we were not the only thieves,

PENGUIN AND YOUNG.

A SKUA GULL ON HER NEST.

for the rapacious skua gull would walk up to a penguin in the most barefaced manner and extract the egg from underneath it. The eggs took exactly thirty-one days to incubate, the temperature beneath the bird being between 70° and 80° Fahr. An actual observation with a thermometer placed alongside the eggs gave 72° Fahr.

During the period of incubation absolutely no food of any kind was taken, but it was observed that large quantities of snow were frequently consumed.

The first young appeared on December 9th. They were quaint little creatures, of a dark slatey colour, darkest towards the head, and with dark feet, and a dark rim around the eye, which, subsequently, changed into the spotless white circle of the parent bird; they grew very rapidly, the dark legs at birth becoming, in a few days, quite pink.

What a spirit of homeliness, peace and industry existed among them There were no fights now. Indeed, the *pater familias* was much too engrossed to think of fighting; family responsibilities rested heavily upon him. Poor fellow, he was really to be pitied; he had to work so hard to satisfy the insatiable appetites of the family. Thousands and thousands of "bread-winners" went fishing each day in the lanes of open water; when filled with crustacea, they return and disgorge into the open mouth of the youngster. This method of feeding the young was interesting. The baby places its head into the open mouth of the parent and devours the food forced up into the throat.

By January 18th nearly all the young birds had discarded their downy coat, and been seduced to the water's edge and taught how to swim by their ever-attentive parents.

Strange to say, all the young birds, unlike the older, had

white throats; evidently, they do not acquire the dark throat until the first or second year.

The skua gulls started to nest on about November 12th. The eggs, two in number, are very handsome, being of a light brown hue with dark brown spots; they are about two inches in length, and four inches in girth. Two days elapse between the laying of the eggs.

One day Mr. Evans very kindly took me to pay a visit to the locality on the side of the mountain where these gulls had their nests; they were very crude, and merely consisted of small depressions in the rock with no pebbles built around after the fashion of the penguins. Near each nest were scattered the remnants of penguin eggs and young, thus bearing eloquent testimony to the rapacity of those gulls. Whilst we were in the vicinity of the nests, the old birds shrieked above us, and attacked us viciously, swooping down at our heads and striking with the wings.

The baby skua is a very pretty, but a very fierce-looking little creature; it is grey with greenish feet and bill, and most beautiful blue eyes.

The snow-petrel (*Pagodroma nivea*) and the Wilson petrel (*Oceanites oceanicus*) both nest high up on the mountain sides of South Victoria Land; the former in long tunnel-like holes under the large slabs of rock, some being as much as six feet in depth, others only a foot or two.

The actual nest is as crude as that of the skua-gull. The female sits on the nest long before she lays her single egg; when the bird is approached in its nest it expectorates a reddish fluid towards the intruder. This fluid has a most obnoxious fishy odour, and no doubt is a very effective means of defence. They are able to eject it to a distance

of eight feet, and if it catches the garments the smell clings to them for many days after. I believe this method of defence is common to most petrels. Some dozens of small white eggs were gathered at a height of 800 feet above the sea.

YOUNG OF THE SKUA GULL IN THE NEST.

The eggs of the Wilson petrel are very large for the size of the bird, and strange to say as many as five were found in the same nest; Mr. Evans, who had found the eggs of these birds on Kerguelen Island, assured us that this petrel never lays more than one egg, so how five eggs come to be in the same nest is not very obvious. I may add, however, that the eggs were not all fresh when found.

No eggs of the brown-backed petrel (*Thalassœca Antarctica*)

were discovered, but no doubt they nest somewhere on the Antarctic shores.

No mutton birds (*Œstrelata lessoni)* were ever seen inside the Antarctic Circle, and the destination of these birds after they leave the Australian waters in the autumn, still remains a mystery.

The mammals of the south polar regions are represented only by whales and seals. Of the former a great number of rorquals (finners) were seen in the summer months, but Ross's assertion that the black or Southern Right whale (*Balaena australis*) of highest commercial importance occurs in great numbers has never been confirmed. Either he was mistaken, or these cetaceans have been almost exterminated by the persistent persecution of the whales in the early fifties.

Of seals, four species were procured. The Ross seal (*Ommatophoca Rossii*), the sea-leopard (*Stenorhynchus leptony leptonyx*), the Weddell seal (*Leptonychotes Weddeli*), and the white seal (*Lobodon carcinophagus*). Easily first in point of size comes the sea-leopard, which is an ugly-looking animal when out of the water; the head is large, the jaws massive, and armed with a formidable set of teeth, and the eyes are very small and fierce. It was exceedingly scarce, only about four specimens being met with during our whole sojourn in Antarctic waters.

The Weddel seal is the most numerous species: a handsome creature, beautifully marked, and with large soft brown eyes almost human in expression. They were got even in the depths of winter, and formed a very important staple of food, the flesh being tender and palatable and in flavour something similar to beef. Their food consists principally

HEAD OF THE TRUE SEA-LEOPARD.

of crustaceous matter, and small fish resembling the anchovy with which the sea teams; the young of these seals appeared at the end of September. On approaching the calf the mother invariably exhibited great anxiety, always getting between her babe and the intruder, and rolls her lustrous eyes about most pathetically, or if the calf is very young, places it under her neck, resting her head on the centre of the calf's body. If you hit the youngster by casting a piece of ice at it, he immediately sets up an infantile uproar which is extremely droll, and the mother accordingly becomes very angry. Of the Ross seal, only three specimens were seen, and the white species was rarely procured near the shores.

An interesting specimen of a shrimp was once found in the stomach of a Weddell seal which was killed on the ice in Robertson Bay on September 3rd, 1899; the accompanying drawings are by the late Mr. Nicolai Hanson, the dimensions being measured from the actual specimen. It will be observed that two of the feet on each side of the body, viz., the second and the fourth, are divided from the joint downwards. The formation of the band on the back is also interesting.

Reptiles and amphibious animals have never been found in the Antarctic regions, and considering the conditions of life needful for their existence they may safely be regarded as excluded from them, excepting perhaps in a state of petrification.

Fishes, however, exist in rich abundance, but little has yet been done to identify and classify them. Besides the specimen already mentioned, a very strange and unusual species was caught during October through a seal-hole, in

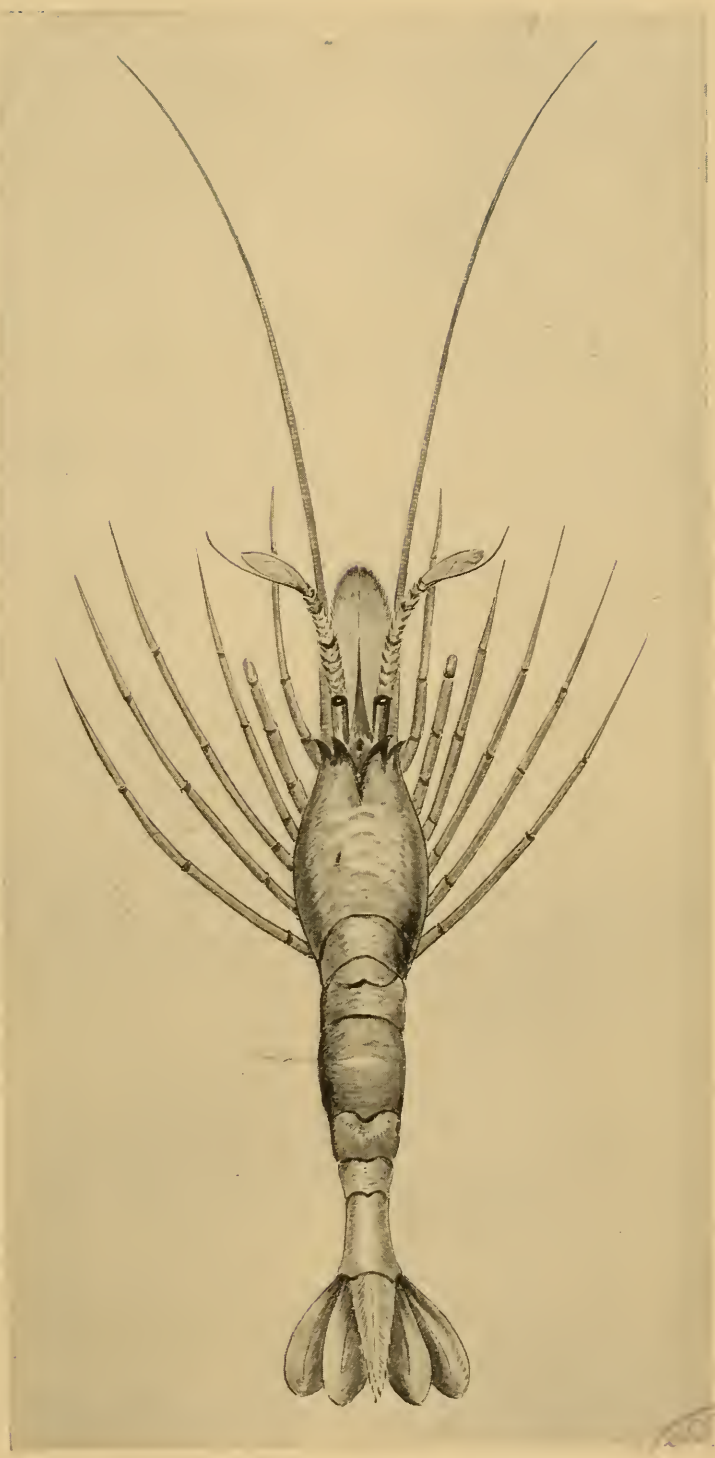
about six fathoms of water. It was a flat fish, and the head was triangular shape, with the lower jaw protruding beyond the upper. Upon this jaw were four teeth, two curling backwards like fangs, and quite outside the mouth. The upper jaw contained eight small teeth; the length of the head was about 3½ inches, and 2½ inches in breadth at the broadest part near the respiratory organs. The total length of the fish varied from 10 to 12 inches.

With invertebrate animals the Antarctic seas swarm, especially in shallow water. Some very prolific hauls of the dredge were made by Mr. Fougner who, after the death of Mr. Hanson, had charge of that work, and beautiful and new kinds of marine life were brought up from the sea bottom; shell-fish, star-fish, worms, all manner of medusæ, and innumerable other things, even a few small pieces of pink coral.

A gigantic medusa was caught in December, which was so large that it took three men to hoist it out of the water. It was a dark brown gelatinous disc or swimming bell about 29 inches in diameter, and from the underside of the bell were suspended the four arms of the polypite. The margin of the umbrella was lobed and handsomely marked with a network of yellow lines, and from this margin or periphery hung tenacles which were of considerable length. The total weight of the specimen was a little over 90 lbs.

The appalling poverty of the flora of the Antarctic regions stands out in glaring light when compared with that of the Arctic regions; for whilst various species of flowering plants are found in high northern latitudes, only the minutest forms of vegetable life, such as lichens and mosses, have

SIDE VIEW *(natural size)*.



BACK VIEW *(natural size)*.

The specimen above was found in the stomach of a seal *(Lobodon Weddelli)* which was killed at the south end of Robertson Bay on Sept. 3, 1899.

[*Drawn from nature by the late* NICOLAI HANSON.

been found in high southern latitudes, and so scanty as only to be found in a few places on the northern slopes.

An interesting discovery in the shape of small insects among the specimens of moss was made by Dr. Klövstad. They were exceedingly minute, but even with the naked eye the antennae could be easily distinguished.

It is very unlikely that any land animals exist within the Antarctic Circle.

CHAPTER IX.

The days grew longer and longer,
Till they became as one,
And southward through the haze
I saw the sullen blaze
Of the red midnight sun.

—LONGFELLOW.

THE long summer days of the Antarctic compensate one for the dreary winter months. The summer, when not interrupted by those fearful storms, is one long vision of loveliness. There is nothing in tropical or sub-tropical regions that can compare with the splendid colouring and purity of a polar summer scene, when all the lofty and majestic peaks of snow are bathed in the soft light of the midnight sun. Midnight without darkness and without stars! and the unwearied sun above the horizon visible right through the twenty-four hours, sweeping round from east to west and from west to east again, and crossing the meridian first in the north, and twelve hours later to the south, about two degrees above the horizon. So much has been written about the midnight sun by those who have witnessed it in the north that it would be trite to enter into rhapsodies here. The light of the sun is soft and yellowish and makes distant objects more plainly visible than at noon, but it is exceedingly deceptive for photographic purposes. Although, on the focussing screen of your camera, the

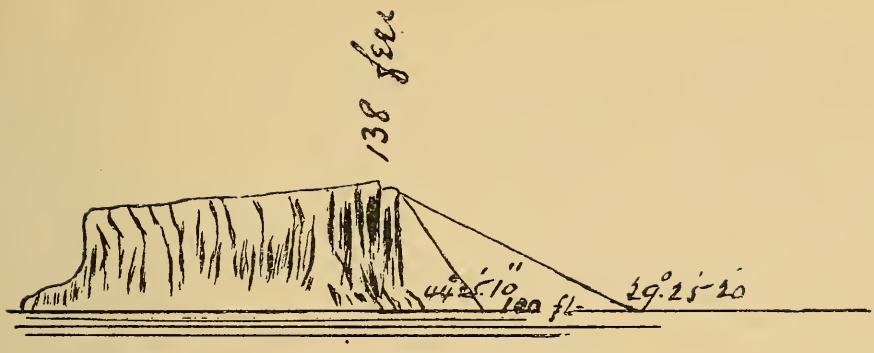
scenery you are photographing looks very bright and clear the light is, to a great extent, non-actinic, and an exposure of from two to five seconds is necessary, whilst for the same picture at noon an exposure of one-hundredth second would be more than sufficient. Its power of warming the air is slight, for the temperature falls considerably as the altitude decreases, but its burning power through a concentrating lens is almost as great as at noon. This can be seen on the burnt cards of the Cape Adare Sunshine Recorder, which is an instrument consisting of a sphere of glass supported in a metal zodiacal frame. A card being inserted in one of the groves according to the season of the year, the sun, when shining, burns away or chars the surface at the points on which its image successively falls, and so gives a record of the duration of bright sunshine. Measurements were taken at this time of the horizontal and vertical diameters of the sun, and the result showed the horizontal diameter to be greater by more than 2′ of arc than the vertical.

The month of November is one of the finest within the Antarctic regions ; although it was still cold, the sun shone almost perpetually, and the detestable south-easterly storms were conspicuously absent. A great deal of scientific work was done during this month, and some beautiful photographs procured. Magnetic observations, generally a troublesome business, were carried on nearly every day, and with greater interest than before, primarily on account of the warmer and calmer weather, and secondly because the observations were much less disturbed than during the other months. Magnetic observations within the polar regions are more difficult to take and of a more delicate nature than in temperate climes, for some of the forces to be measured are smaller and weaker

than elsewhere, and, therefore, much more susceptible to exterior disturbances. Thus at the so-called magnetic poles the compass needle has no fixed direction, the declination having any value from 0° to 360°. This is due to the fact that at these places the part of the earth's magnetic force which acts on a compass needle has dwindled to nothing.

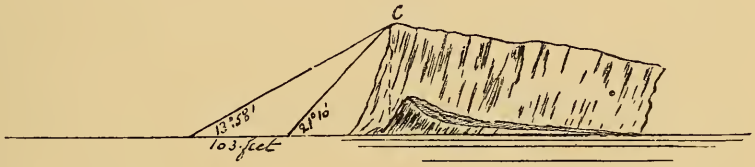
The magnetic poles of the earth are those points on the earth's surface where the dipping needle stands exactly vertical. These poles are the poles of rotation, but do not coincide with them. The north magnetic pole lies in Latitude 70° 51′ N. and Longitude 96° 46′ W., and the south is approximately Latitude 73° S. and Longitude 146° E. These magnetic poles are not to be compared with those of a bar magnet. The earth is really a great spherical magnet, and the external action of such a magnet is analogous to that of a bar magnet at the centre of the sphere. An explanation of this would be of a too technical nature; suffice it to say that there is a very strong suspicion that the earth's rotatory motion has an important share in the production of the earth's magnetism. Our knowledge of the magnetic forces in the south polar regions is for the most part hypothetical, and therefore observations there not only advance, in a general way, our knowledge of terrestrial magnetism, but they are also of great practical value in correcting our navigation charts, and give us an idea of the periodic changes, for the forces are by no means constant; a value determined to-day would be of little use twenty years hence unless we knew exactly the amount of annual variation.

There is, perhaps, a connection between terrestrial magnetism and the force of gravity at the earth's surface, but until more gravity observations have been taken in high latitudes



August 10. 1899. Given height of berg 138 feet

Base 100 ft
Angles of Elevation 44°.25'.10" ; 29°.25'.20"
Height of Eye 5 ft 3 in



Base line = 103 feet
Angles of Elevation from extremities of base = 21.10' ; 13.58' , Height of Eye 5 ft 3 in
Given height of iceberg 76.8 feet
August 12 1899
Robertson Bay

August 30 1899.

Base 100 feet
Angles 32°.4', 21°39'40" ; Height of Eye 5.2 ft.
Given height of iceberg 113.7 ft
Water drifting from shaded side of berg; Temp in shade - 15°F
Bright sunshine

Measurements of heights of icebergs in Robertson Bay

this connection cannot be followed. There is, however, a very marked connection between terrestrial magnetism and the *Aurora Polaris*, which still remains to be explained. During the continuance of an aurora the indications of the magnetic instruments are much disturbed, and there is what is called a "magnetic storm." There is also some relation between terrestrial magnetism and sunspots. Much as the mathematical theory of terrestrial magnetism has been developed, of the physical theory of that mysterious force in nature, we are yet in perfect ignorance. This defect is certainly, to some considerable degree, caused by the want of our knowledge in higher latitudes.

I had an opportunity at this time of very carefully measuring the height of half a dozen icebergs imprisoned in the frozen surface of Robertson Bay, and the mean height thus derived was about 100 feet, the maximum being 140 feet. There was one very singular phenomenon observed in connection with these icebergs during one of the winter months. It was on the 30th August, the temperature in the shade at the time being $-15°$ Fahr. ($-26°$ C.) with a perfectly clear sky and a glaring sunshine beating on the north walls of the bergs. From the south walls, upon which, at that time of the year the sun never shone, drops of water were oozing out from top to bottom. I have not been able to find any solution of this phenomenon at such a low temperature.

The typical form of the Antarctic iceberg is very simple. The top is a nearly flat expanse of snow, and this is bounded all around by perpendicular cliffs. Although there is about eight or nine parts of the berg immersed, it must not be supposed that below water there is nine times the vertical

THE BREAKING-UP OF THE ICE AT CAPE ADARE.

depth of height of the part above water. Long ledges run out from the base of the cliffs below water; the immersed part being thus much larger in figure than the exposed.

The exposed part is also much lighter and less compact ice. The bergs seem nearly always to be of large area in proportion to their thickness, and to maintain their original balance for very long periods. Of many thousands of bergs seen, we did not observe one which had tilted.

No doubt the much greater density of the ice, composing the lower portions of the berg, tend to keep them in their original position.*

These huge icebergs are shed from the heavy cappings of perpetual ice and snow which bury the great Antarctic land masses. The ice and snow which form on the slopes of the mountain ranges, facing the interior of Victoria Land, descend to the lower reaches, where they accumulate in vast undulating fields and plains, hundreds of feet in thickness, and ultimately this great glacier, or ice-cap, is pushed out over all the low-lands into the ocean, forming there the true ice-barrier, a solid perpendicular wall of ice, probably from 1,200 to 1,500 feet in thickness, rising from 150 to 200 feet above, and sinking 1,100 to 1,400 feet below, the level of the sea. When the forefronts of this great creeping glacier are pushed into depths of about 300 or 400 fathoms, large stretches are broken off, and float away as the oft-described, perpendicular-faced, horizontally-stratified, table-topped icebergs of the Antarctic and Southern Oceans, which may be miles in length, and usually float from 150 to 200 feet in height above

* *See* "The Renewal of Antarctic Exploration," by Dr. John Murray, F.R.S., *Geographical Journal* for January, 1894.

the sea-surface—majestic and sublime sentinel outposts of Antarctica.

The late Dr. Croll used to speak of an accumulation of ice and snow at the South Pole, ten and even twenty miles in thickness ; but from all we know of the properties of ice, and the relation of its melting—or freezing—point to temperature and pressure, it is highly improbable that such a thickness of ice will be found on any part of the Antarctic lands. Ice at the temperature at which it is in contact with the surface of the earth's crust within the South Polar regions, cannot support a column of itself much more than 1,600 feet high without melting.

Towards the middle of November, the frozen surface of the surrounding sea commenced to break up. A broad sheet of open water first formed around the extremity of the Cape and swept out towards the west. How delightful it was to behold the delicious sparkle of the sea once more, and to hear the soft lap of the waves ! Only one who has been imprisoned in ice fetters for many months, as we had been, can understand that feeling. Flocks of thousands of penguins now toddled to and fro between the shore and the water. Those arriving grimy and sordid of appearance, and those returning neat, clean and glossy. Thousands were standing along the edge of the ice ready to take their plunge into the brine, but hesitating like children. As soon as one plunges in all follow in rapid succession. Others again were sporting about in the water and enjoying themselves immensely—racing along and leaping out like dolphins ; by the uninitiated they might easily be mistaken for such. As soon as they tire of their frolics they all leap up again on to the ice and then no amount of persuasion will induce them to

EMPERORS IN CAPTIVITY.

enter again. In this respect, as indeed in all, they were most obstinate.

Whilst we were thus watching them a large handsome Emperor Penguin suddenly shot out of the water on to the ice within a few yards of us, and gazed around in a quiet, dignified fashion, looking like a giant among the smaller ones. Strange to say, the small penguins were afraid of him, and gave him a very wide berth. We endeavoured to get between him and the water's edge, so as to capture him, but he was much too wise for us; he perceived our little manœuvre, and quietly took "a header" back into the sea. Ten of these large penguins were, however, captured some days afterwards, and were incarcerated in a square made of boxes, but somehow they overturned the cases and effected their escape.

We were able now to go for a row on the open patches of water in "kayaks" and canvas boats, and these little trips, although perhaps not equal to rowing or punting on the Thames during Henley week, were nevertheless of a most delightful nature, but great care was necessary in order to dodge the loose floating masses of ice driving along by the current at a considerable speed. The velocity of the current or tide rushing in and out was extraordinary. It must have been between six and seven knots an hour when rushing out towards the north-east. Whilst the tide was running out or ebbing the ice moved out with it until open water was visible to the horizon, but it quickly moved in again with the tide until some hours later there was only a narrow strip of water a few hundred yards in width. The pellucid clearness of the water enabled one to see the bottom distinctly, upon which all manner of beautiful crustacea were crawling. Some most interesting and new specimens of marine fauna were procured

at this time by Mr. Anton Fougner, whose beautiful collections now rest at the Natural History Museum in London. In the surface waters of the Antarctic there is a great abundance of diatoms and other marine algæ, and the small crustaceans are the chief food of the whales, seals, and penguins which abound in the waters of the Great Southern Ocean.

Towards the end of November a short sledge journey was undertaken to the bottom of Robertson Bay, for the purpose of collecting eggs of the snow-petrels. Travelling on the surface of the bay ice, which had already commenced to break up, and was traversed by huge cracks and open lanes, was difficult work. The surface snow, too, was soft and slushy. A large number of eggs, however, were gathered, together with some good specimens of moss, and some beautiful photographs of the coast line were procured.

On the morning of December 3rd extensive preparations were made for observing an eclipse of the sun. Indeed, preparations were made some days before, and the local time of beginning and ending, the position angles of contact, and the magnitude of the eclipse were all carefully calculated. A successful observation of this eclipse would have given us very accurately the longitude of Cape Adare. An accurate determination of longitude in those high latitudes would have been of immense value to any exploring ship subsequently visiting the same locality, for it would have enabled her to rate her chronometers by merely sighting Cape Adare; but for all our careful preparations we were disappointed; not a glimpse of the eclipse, nor even of the sun, did we see. A dense pall of Nimbus and Cirrus-Stratus cloud hid all from view. The only observations possible to take were meteorological and some imperfect tidal observations. During the eclipse, which

STRANDED ICE-BLOCKS.

lasted a little over two hours, an ordinary mercury thermometer in the screen fell 1° Fahr., and an ordinary bright-bulb thermometer placed outside and facing the hidden sun sank 8° Fahr.

The following are the tidal observations:

Time.		Depth of Water.	
a.m.		ft.	in.
9 0	.....	50	9
10 30	.....	49	6
p.m.			
0 27	.....	48	6 middle phase of eclipse
1 35	.....	48	6
	Difference	2	3

The day before the lowest tide (slack water) was at 3.45 p.m., when the depth was 51 ft. 10 in. The highest tide (slack water) was at 8.30 p.m., the depth of water being 55 ft. 2 in. The difference is therefore 3 ft. 4 in.

Tidal observations to be of any value should be taken regularly for a period of not less than a fortnight, and with a properly-constructed tide gauge. Tidal observations on the Antarctic shores, according to Professor G. H. Darwin, "would be of especially great interest, since this is the only region of the earth in which the water is uninterrupted by land."

As the solar eclipse observation was a complete failure we accepted for the longitude of Cape Adare an observation determined, on November 6th, 1899, from an occultation of the planet Saturn by the moon, viz., 170° 9′ 30″ E., and which was adopted as being more correct than chronometer observations, which gave about 170° 12′ E. Sir James Ross, in 1841, gave the longitude of Cape Adare 170° 45′ E., but he determined this longitude at some distance from the coast,

and a small error in his estimated distance would cause a comparatively large error in his longitude.

Towards the end of December all the shore ice had broken up and drifted away. An anxious watch was now kept for the returning ship; she was expected to reach us before Christmas Day, but Christmas Day came and went and New Year's Day too, and still there was no sign of the *Southern Cross*. Christmas Day was hopelessly dull, for an appalling storm blew all day from the east-south-east with its usual auxiliary—dense masses of drifting snow. Outside the little hut the wind howled in a most lugubrious manner, and inside, mental oppressiveness and silence reigned; so we were scarcely delirious with joy nor even mildly gay.

New Year's Day was slightly more cheerful. The last day of the old year was dull on account of a storm blowing which kept all of us indoors, but the following day was bright and clear; the first fine day we had had for three weeks, and a fitting one for the beginning of a new year. We lay on the roof of the hut most of the day, basking like so many seals in the genial rays of the sun. On the whole, January was perhaps the gloomiest month we spent at Cape Adare; storms swept down upon us incessantly, one lasting without intermission for seven days. Day after day one or other of the members would climb to the top of Cape Adare, armed with a telescope, and gaze eagerly across the ocean for a sight of the ship. But it was always the same report, "no ship in sight," nothing to be seen but the waste of waters and drifting masses of ice. Matters began to look grave; it seemed as if some accident had befallen the ship and we were doomed to remain upon that land of desolation for another year, perhaps two, and that was an incubus too

CLIMBING TO THE TOP OF CAPE ADARE TO LOOK OUT FOR THE SHIP.

dreadful to dwell upon. Our provisions, with rigid economy, would hardly have lasted another year, and our supply of coal perhaps six months.

Very little work was done. A feeling of impatience and unrest prevailed among the members which is indefinable. Owing to the non-arrival of the ship spirits sank below zero and rarely rose above. *Fato profugus* indeed! more so than poor old Father Æneas. We were quite helpless, for we had not even a boat. We were bounded on all sides but one by a wide stormy ice-swept ocean, and on that one side there were lofty impenetrable snow clad mountains which lead towards the most desolate spot on earth—the Pole. But at last our long polar incarceration came to an end, and quite suddenly and unexpectedly.

One day (January 28th) early in the morning, when we were all asleep in our bunks, a voice in the tiny hut calling out "Post" broke upon our slumbers. It was the voice of Captain Jensen, the sailing master of the *Southern Cross*. With what hysterical joy we tumbled out of our bunks to welcome him. With what eagerness and trepidation we received our letters, scarcely daring to open them for fear of bad news, but luckily there was no such news for anyone. It is impossible to conceive the pleasure derived from letters and even newspapers after having been so long cut off from civilisation. It was then we heard for the first time of the Great Boer War which had broken out during the previous October.

CHAPTER X.

'Mid these wild scenes enchantment waves her hand
To change the face of the mysterious land ;
Till the bewildering scenes around us seem
The vain productions of a feverish dream.

—SCOTT.

OUR last day at Cape Adare and a long farewell. It was one of the most bleak and ungenial days imaginable. Heavy masses of nimbus cloud hung over the snow peaks, hiding them from view—a kind of grand ringing down of the curtain!

We were not sorry to leave that gelid desolate spot, our place of abode for so many dreary months. In the morning we visited Hanson's grave on the summit of the Cape, and erected a neat black cross, bearing a brass plate with his name, etc., inscribed thereon—our last tribute of respect and esteem to the dead.

February 2nd, 1900.

A photograph was taken of the grave, which proved a fairly good one considering that it was snowing heavily at the time. By five o'clock everything was on board, including all the dogs, and an hour later, with a long sigh from the steam whistle and a longer one of relief and release from ourselves, we moved out towards the Cape, rounded it, and set out on our course to the South, keeping an average of from three to five miles from the coast. At midnight, we

sighted Possession Island. The coast-line from Cape Adare to Cape Downshire is exactly similar to that in Robertson Bay. The same igneous formation, with precipitous cliffs here and there, pillars of rock standing alone at a short distance from the shore, such as the two pillars off Cape Adare. It was so misty that very little could be distinguished. The temperature at 9 p.m. was 28° F.; the barometer 29.13 inches; the weather calm, overcast and snowing, and loose fields of ice and a few bergs were to be seen from the deck.

We were awakened very early next morning, in order to land upon Possession Island. The Possession Islands are in Latitude 71° 56′ S. and are situate a short distance from the mainland. It was a cold, bleak morning—snowing, and a fresh breeze blowing from the South. On account of the threatening appearance of the weather, it was deemed advisable not to lose any time in taking magnetic observations. We landed on a rough pebbly beach, on the western side of the largest island.

Although there was a strong current running, there was not much surf, and landing was accomplished with facility. The island upon which we landed and which is the largest of a small group, is low—the highest part, a peculiar abrupt bluff on the south side, being about 300 feet high. It is almost entirely covered with a snow cap averaging from one foot to twenty feet in thickness, and the whole island is, I should say, about three miles in circumference. Numbers of penguins, skua gulls and giant petrels were to be seen. An ordinary seal (*Leptonychotes Weddelli*) and a sea-leopard, voraciously intent upon a penguin, were also observed in the water close to the shore. Immediately on landing, the

February 3rd.

whole party proceeded to a spot where the members of the ship *Antarctic* had placed a post bearing a letter, in January, 1895. The paper was found in a tobacco box, nailed to the post, and in a perfect state of preservation. The letter was short, and merely stated that the ship *Antarctic*, Captain Khristensen, had called there on the 18th of January, 1895. After having placed a pencilled note signed by each member of the party in the tin box, it was again secured.

We roamed about over the island for about half-an-hour, took some photographs, which were not very successful, for it was snowing at the time, collected some geological specimens, found some green vegetation similar to that at Cape Adare, and procured some young skua gulls.

But for the fact of its being an island, this place is much better adapted in every way as a winter quarter than Cape Adare. There is much better shelter. The terrible winds which sweep across the latter place are not so potent here, as is evident from the greater accumulation of snow. There is not so much local attraction for the magnetic needle, and the meteorological conditions are perhaps more normal. We returned to the ship at about 8 a.m., a fresh southerly breeze had arisen, and we had some difficulty in getting on board.

We saw many large dark rocks to the south of the island —two being basaltic pillars rising abruptly out of the sea and attaining a height of about 100 feet. In another rock, the sea has perforated three arches, one so large as to almost admit the passage of the ship. At nine o'clock we were off Cape Rogel. A large body of ice lay off it and at the mouth of Mowbray Bay, so we were compelled to make a long détour towards the east to avoid it. Towards the

CAPE WADWORTH, COULMAN ISLAND.

afternoon, the thick mist commenced to rise from the great snow ranges and the clouds to disperse. In a few hours it was quite clear, and we obtained a glorious view of the coast—stretching away to the southward in the form of magnificent ranges of mountains, completely covered to their sharply pointed summits with snow. The temperature of the air during most of the day was 28° F., and of the sea 30°.6 F. The barometer fluctuating between 29.1 in. and 29.3 in. At six o'clock we were off Cape Hallett, at a distance of about two miles. It is a bold rugged headland, about 1,000 feet high, and partly free of snow cap. Photographs were taken during the afternoon of the coast-line, especially Capes Christie, Cotter and Hallett. Towards evening, Coulman Island was sighted.

Early next morning we were close under its western shore, which looked so precipitous that we entertained but little hope of effecting a landing. At one place, a perpendicular cliff, some 1,500 feet high, fell sheer into the sea; to the right and left were the walls of the ice-cap or glacier, about 100 feet high, and extending for some distance out into the sea. The Commander, Colbeck and I started a little before nine a.m. in a boat, determined, if possible, to effect a landing. On nearing the shore we met with some difficulty in the shape of heavy blocks of ice, upon which the surf was breaking. After some searching we succeeded in finding a spot at the base of the cliff, where, after some risky manœuvring in the surf, we managed to leap ashore. Thus we were the first to land upon Coulman Island.

However, there was nothing to see except the walls of the cliff—the formation of which is volcanic and similar to that at Cape Adare. After taking a few photographs, we returned to

February 4th.

the ship. We stayed on shore exactly twenty minutes. The impossibility of taking accurate magnetic observations at the base of a huge, strongly magnetic basaltic cliff is obvious, and we did not attempt it. Indeed, apart from the local attraction, the risk of landing the instruments, with such a surf on the shore, was too great. Coulman Island is on an average 1,000 feet high, and, with the exception of the steep face of the cliffs, is completely enveloped in ice and snow. It has a length of between ten and twenty miles. Having regained the ship, we directed a course for the mainland, due west of Coulman Island, and distant about fourteen miles. A variation observation taken with the ship's compass at about 7.30 a.m. gave the variation 96° E. Soon after noon, we rounded an unnamed cape which the Commander christened Cape Constance, after his wife, Round this cape we found low land, or, I should say, the edge of the great ice-cap at this spot was low. Steaming along the edge of the ice barrier, we discovered a kind of inlet or arm running into the glacier for a distance of about three miles, with perfectly smooth ice between and fastened to the walls of the glacier. This spot was well sheltered from winds and the great inland ice-cap was easily accessible. A rookery of seals, some hundreds in number, could be seen laying on the ice at the bottom end of the arm, and two emperors and one small penguin were observed. We made fast to the edge of the ice, and landed the magnetic instruments as quickly as possible. A party with sledge and dogs started off to have a look at the seals. These seals proved to belong to the species *Leptonychotes Weddelli.* They were laying alongside a crack in the ice, most of them asleep. They were totally unconcerned at our presence and evinced not the slightest interest in us. Two or

CAPE TO THE WEST OF CAPE WADWORTH.

LANDING PLACE, COULMAN ISLAND.

three of the party climbed to the top of the ice-cap on *ski*. From the top, the ice-cap sloped gradually inland as far as the eye could see, and appeared to be perfectly smooth and unfissured.

We found it impossible to take a set of vibrations for magnetic intensity, on account of a slight swell on the ice, which, considering the calmness of the day and the character of the ice upon which the observations were taken (it being attached firmly to the barrier on each side) rather astonished us. Probably we were too close to the edge. After having taken some more photographs we returned to the ship, and were soon under way again. During the four hours we were fastened to the ice-barrier a very heavy ice-pack had moved in, and we had some trouble in getting out. Towards morning we were in open water again, to the north-east of Coulman Island, and almost out of sight of land. The ice-pack between Coulman Island and Cape Johnson preventing any near approach to it.

The next day we were almost out of sight of land. A long deep swell from the south, indicated much open water in that direction. The sky was clear, and there was but little wind. Many ice petrels were seen. The temperature of the air was 28° Fahr., and of the sea, 30° Fahr. February 5th.

Our Latitude at noon was 74° 32′ S. and Longitude 168° 2′ E. We had thus passed beyond Weddel's farthest South. The variation of compass was 140° E. We could not understand this large variation. Ross, in 1842, in almost the same locality, found it to be only 67½° E.

At about noon we sighted Mount Melbourne to the W.S.W. We were all struck by its extraordinary resemblance to Mount Etna. Rising up gradually out of the sea

to an altitude of nearly 8,000 feet, with a canopy of cloud upon its peak, it presented an imposing sight. All afternoon we steamed down Wood's Bay, which runs much farther inland than indicated on Ross's chart. At the bottom of it there is a long inlet or fiord, affording a capital harbour. At nine o'clock in the evening we landed in a boat on a pebbly beach at the foot of Mount Melbourne. The place upon which we landed was a pebbly bank even larger in extent than that at Cape Adare, entirely free from snow and "ponds," and occupied by penguins and skua gulls. A better spot for winter quarters it would be difficult, if not impossible, to find in those latitudes. It is the only place in South Victoria Land where a ship can winter with perfect security.

February 6th. As regards danger from storms and ice-pressures. In the first place, it is well outside the area of lowest barometic pressure, so that storms are not likely to be so severe as at Cape Adare and, judging from the absence of piled-up masses of ice on the south shore and from the perfectly smooth nature of the sea-ice that filled some of the small indentations, the screwing of the ice in the bay during the winter is inconsiderable. Landing can be effected with ease and safety at numerous points on that part of the south shore west of Mount Melbourne. There is one objection to Wood Bay, viz.: the possibility of the winter ice not breaking up every summer, and thus the ship would remain fast, but this is an uncertainty common to most polar harbours. However, the bay is very large and there is nothing to show that the ice conditions of one year are any different to another. From here there is quite an easy access to the great snow-cap; not more than 100 feet to climb, and a very gradual gradient. This part of the coast is actually the closest approach to the magnetic

THE SEAL ROOKERY.

pole, it laying in an almost due westerly direction from here distant between 200 and 300 miles.

I do not, however, wish to imply that observations can be taken in the vicinity of the magnetic pole without much difficulty, for it is quite within the bounds of possibility that an open sea may be encountered before reaching a distance of 200 miles; that is, if an archipelago of islands exist, instead of a vast continental area.

If a land party should winter near Mount Erebus and Terror, there is an easy way of communication between such a party and a ship wintering in Wood Bay by means of an uninterrupted ice-foot, which, commencing from the southern slopes of Mount Melbourne, continues southwards as far as McMurdo Bay. The surface of this ice-foot is perfectly level, covered with hard, compact snow, and is but little crevassed—as was actually determined by two landings upon its surface in the vicinity of Cape Gauss, which is itself buried in the ice-sheet.

The distance between McMurdo Bay and Wood Bay is about 170 miles which, with sledges and dogs over such favourable conditions for travelling can be covered in eight days.

The surface of the ice-foot is easily reached from Wood Bay by going round the foot of Mount Melbourne from behind. The geological formation here was volcanic, but not compact or magnetic rock. It consisted mostly of scoriæ and ashes, no doubt ejected from Mount Melbourne, which, most probably, was at one time a volcano in activity. Some pieces of slate were seen on the beach, but, being engaged in taking magnetic observations, I had no time to search for any outcrop of this formation. The result of our Dip observation was 88° 2′ 37″.

Ross observed a Dip in 1841 out at sea of 88° 33′, Mount Melbourne bearing at the time N.82° miles West, so that the value we found is evidently much smaller than in 1841. As there was no sun visible, it being obscured by the mountain, we were unable to observe the declination and not sufficient time could be spared for intensity observations. Whilst working, sharp detonations, like gun-shots, were frequently heard emanating from the ice-cap. The exploring party returned at about half-past eleven with some interesting geological specimens and some very fine thick moss. We had some difficulty in reaching the ship on account of the heavy ice-floes which had moved in between her and the shore. Indeed, the heavy and close ice-pack in the Bay and the possibility of the ice not breaking up every summer is, I think, the only grave obstacle to hibernation in this locality. At 9 o'clock next morning, we rounded Cape Washington, a bold truncated headland about 1,000 feet high. Off the Cape we encountered a long, deep swell from the south, which caused the ship to pitch heavily, and was by no means comfortable. The wind blew very strong from the south-

February 7th. east for about two hours during the early morning, but this soon subsided, although the swell remained nearly the whole day. We now steamed southwards at a distance of about 15 miles from the coast, or, more accurately speaking, from the edge of the ice-barrier—for, from Cape Washington southwards, the ice-cap sweeps over the comparatively low land and extends for many miles out to sea, terminating in a perpendicular ice-barrier of from 50 to 150 feet in height.

This was the coast-line which was invisible to Ross in 1841, on account of the ice-pack which intervened between his ships and it, and prevented him from approaching close.

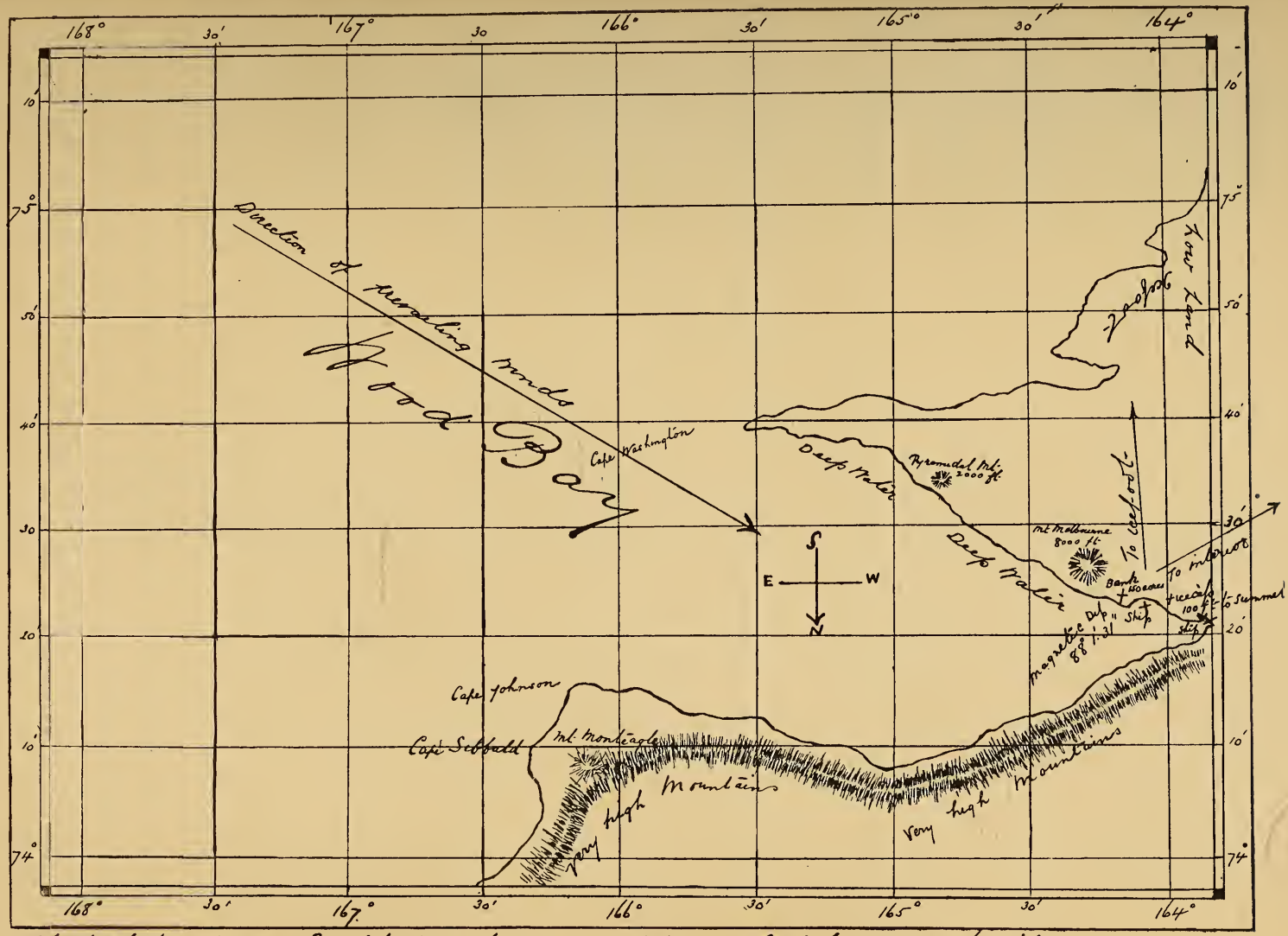
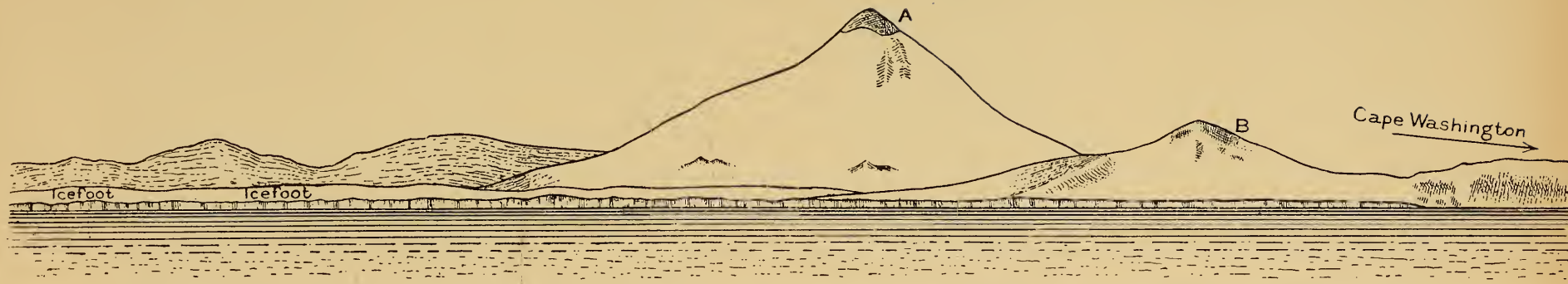


Chart of Wood Bay, South Victoria Land. Note 1° of Longitude = 16 miles

Mount Melbourne marks the boundary of the coast actually seen by Ross. He was, however, able to see the comparatively low mountain range, which he named the Prince Albert range. At 3 o'clock on the following morning, we made fast to some ice attached to the foot of the barrier and took a Dip observation which gave 87° 47′ 5″, indicating that we had passed to the south of the magnetic pole. The sun not being visible, we were unable to get the declination. We saw many seals asleep on the ice.

The temperature of the air during the day was, maximum 32° 3 F. and minimum 17° 2, and of the sea, maximum 30° 5, and minimum 28° 5. The barometer varied between 29.184 and 29.330 in. Taking observations at those places and at such hours is scarcely comparable to working in an observatory such as at Kew. At 11 a.m. we again made fast to the ice-barrier, at a place about 30 miles south of the former spot, and again took a Dip observation which gave 87° 34′ 51″. It was evident that we were now considerably to the southwards of the magnetic pole, and that the change in its position had been considerable since 1841. The ice-barrier at this spot was very low and Lieut. Colbeck and I were able to climb to the top. The sight that met our eyes was ineffably desolate. Nothing was visible but the great ice-cap stretching away for hundreds of miles to the south and west. Unless one has actually seen it, it is impossible to conceive the stupendous extent of this ice-cap, its consistency, utter barrenness, and stillness, which sends an indefinable sense of dread to the heart. There is nothing beautiful to contemplate, no contrasts, absolutely no diversity, but for all that it is majestic and affords a profitable theme for meditation. What a contrast between the terrible immutabillity of those regions and the mobility of modern



SOUTH SLOPE OF MOUNT MELBOURNE, SHOWING WHERE ICE-FOOT, CONNECTED WITH MCMURDO BAY, BEGINS.
A, Mount Melbourne, 8,000 feet high; B, Pyramidal Mount, 2,000 feet high.

civilisation! Nature here goes on her wondrous way, working now as steadily, as harmoniously, and as surely, as she did before time was, and as she will continue to do, when time shall be no more. Soon after getting under weigh again, we encountered a heavy ice-pack and we were compelled to steer E. and N.E. true in order to avoid it.

We steamed all night eastwards through heavy ice-pack. At about 10 a.m. we cleared it, and met with a swell from the south. An hour later, we sighted Franklin Island, which is in latitude 76° 7′ and longitude 168° 20′ E. On the north extremity of this island are lofty black basaltic cliffs; the rest is entirely covered with a snow-cap, and is on an average 1,000 feet high. At 6 p.m., we effected a landing without any difficulty on an extensive pebbly beach on the west side of the island. This pebbly beach, similar to the one in Wood's Bay and at Cape Adare, was occupied by thousands of penguins. The young birds were not in so advanced a state of development as those at Cape Adare and Possession Island. Lieut. Colbeck and I were engaged taking magnetic observations whilst the rest of the party went off exploring. The Dip observed was 86° 52′ 13″. Ross in 1841 observed
February 9th. a Dip twelve miles to the north of the island, of 88° 24′. So that the decrease in 59 years amounts to 1° 32′, or an annual decrease of 1′.56. This places the magnetic pole much farther north and west than previously supposed, distant about 250 miles west by north from Wood's Bay. The weather was thick and snowing heavily during our stay on the island, and as it was impossible to observe the sun for magnetic declination it was decided to return to Franklin Island on our homeward journey, and then complete the observation.

COMMENCEMENT OF THE ICE FOOT ON SOUTH SIDE OF CAPE WASHINGTON.

FRANKLIN ISLAND.

Some valuable geological specimens were procured by the exploring party, one being a heavy yellow vitreous rock of volcanic origin. Some moss was also procured, which proved the existence of vegetation in so high a latitude. The soundings taken by Ross indicate that Franklin Island may be regarded as the highest point of a volcanic ridge extending

FOOT OF MOUNT TERROR, NAMED CAPE TENNYSON.

from north to south, for fourteen miles north of the island a sounding was taken, in 1,194 feet of water, and the depth gradually decreased to 305ft. six miles to the north-west, and to 220 to 250ft. at two and a half to four miles out. On the south side a line of rocks, just showing above water, extends for a considerable distance out and are a source of danger.

Whilst we were ashore, some very rich dredge hauls were

made by Mr. Fougner in shallow water, and some interesting and beautiful specimens of marine life caught in a depth of ten fathoms, including numbers of star-fish, large and small; some specimens of sea-urchins; sponge, shell-fish, sea-weed, and a single piece of white coral.

We were again under weigh at 7.30 p.m., and steering straight for Mount Erebus, which we expected to sight early on the following morning. The south and most conspicuous Cape of Franklin Island, which was unnamed, the Commander did me the honour of calling Cape Bernacchi. McMurdo Bay was not approached; a close examination of this bay would have been of some value, for possibly there is a spot on its shore where a party might be able to winter, but the discovery of a sheltered inlet where a ship could safely winter, is, I think, extremely improbable. Early in the morning we passed Beaufort Island, a high, round island, about ten miles to the west; soon afterwards, we sighted Cape Crozier and Cape Bird and the foot of Mount Erebus and Terror, but the dense masses of clouds wholly obscured all but the immediate coast line. At noon we were about seven miles west of Cape Crozier, and close in under Mount Terror. Our Latitude was 77° 17′ 30″. Variation of compass 130° E. Here we lay to, waiting for the clouds to disperse in order to get a view of the summit of Mount Erebus, and to obtain a photograph of it. Whilst thus waiting a sounding was taken at a distance of about two miles from the shore to a depth of 150 fathoms, without finding bottom.

There was a small, dark rock, scarcely a headland, between Cape Bird and Cape Crozier, which the Commander christened Cape Tennyson. As it was quite calm at the

CAPE CROZIER AND BEGINNING OF GREAT ICE BARRIER.

time, the Commander decided upon landing here; Lieut. Colbeck and four Norwegians accompanied him. He took ashore with him a small Union Jack and a letter, the latter to be left ashore for future ships, as evidence of our having called there.

February 10th. After having landed, he sent Colbeck back with the boat for a small camera, and whilst the latter was returning to the shore, an incident happened which might have resulted in loss of life, and, at any rate, shows the danger of landing at the foot of a cliff overtopped with an ice-cap. Owing, no doubt, to the vibrations of a geological hammer on the rocks at the foot of the cliff, and that of the voices, a large part of the ice-cap above suddenly became dislodged, and some thousands of tons of ice fell into the sea with a terrific and reverberating roar. The two below, hearing the noise overhead, at once rushed as high and as close into the cliff as possible. The danger, however, from the falling mass itself was little, for it fell far out into the sea, but the danger was from the wave to which it gave rise. Immediately the mass of ice had fallen, a huge wave, presenting a front of some eight feet in height, rushed in towards the shore and swept upon the two as high as their breasts, nearly carrying them off their feet. It was fortunate that Lieut. Colbeck was sent on board for the camera, as there was only standing room for two out of reach of the wave, so that if there had been three, one must inevitably have been swept into the sea.

As the pall of clouds showed no signs of breaking, we waited no longer, but steamed on towards Cape Crozier, which we passed a little before midnight. At about this time the mist rose from Mount Terror, and we obtained a

fairly good view of it from base to summit. It is, of course, very lofty, but scarcely looks the height (10,900 feet), that Ross assigns to it. Strange to say, it is almost free of snow on its eastern side, even near the summit. Possibly it is exposed to winds. On the eastern side are many knolls, some having crater mouths, and which, at one time, were the monticules of the parent volcano, now apparently extinct. The most ardent advocate of Imperial expansion would scarcely look to this territory surrounding Mount Erebus and Terror as a sphere for his ideas. It is an unfinished portion of the universe, where the elements of chaos are still allowed to rage with unbridled fury. Even stranger than the absence of snow on Mount Terror is the existence of an exceedingly large penguin rookery at the foot of the mountain, and near Cape Crozier. This rookery was occupied by millions of penguins, and was far and away larger than any we had previously seen. The brown discolouration caused by these birds can be seen some miles off.

The foot of Mount Terror is low, and at the spot occupied by the penguins there is a kind of miniature plateau, upon which a party could possibly spend a winter, although I believe it would be a severe one. The top of the Great Ice Barrier is only about three miles from here, but whether or not it is possible of attainment with dogs and sledges, we were unable to determine.

After having passed Cape Crozier, Ross's Great Ice Barrier came in view, stretching from the above-mentioned Cape away out of sight towards the east. Just as the Pyramids, the hanging gardens of Semiramis and the Colossus of Rhodes are marvels of production of the human intellect in

the past, so is the Great Ice Barrier one of Nature's marvels of production. It was the most marvellous sight I had ever seen in my life; no words can adequately describe it:

> "Imagination's utmost stretch
> In wonder dies away."

Scarcely any natural feature of the Antarctic world has at any time so stirred the imagination and so roused scientific interest as the discovery of this Great Ice Barrier. The most surprising characteristics of the Great Ice Barrier are its unbroken uniformity, its vast extent, and the entire absence of visible land from its edge.

Imagine a perpendicular wall of ice, from 100 to 200 ft. high, suddenly rising up before you out of the ocean, where the depth of that ocean is measured by hundreds of fathoms, and hundreds of miles distant from any visible land, for you soon lose sight of Cape Crozier and Mount Terror. There are no breaks in this wall, and it is very little water-worn, proving the rare occurrence of gales from the north and the accompanying high seas, which would otherwise wear huge caves into it; its summit affords absolutely no obstacle for travelling with sledges and dogs, being smooth and level and but little crevassed.

A theory has been advanced and very widely accepted that the Great Ice Barrier is the front of a huge polar ice-cap, which moves from the South Pole northwards. It has even been calculated that the centre of this polar ice-cap must be three miles, and may be twelve miles, deep, and that the material of this ice mass being viscous, its base must spread out under the crushing pressure of the weight of its centre, and the extrusive movement thus set up is supposed to thrust the ice-cliffs off the land at a considerable rate.

The improbability of this theory is evident to those who have carefully observed the barrier and the ice-caps of that part of the Antarctic, which cannot possibly be more than 2,000 ft. in depth.

The following theory with regard to the formation of the Great Ice Barrier I hope may bear logical scrutiny. In the first place reasoning from analogy. All the ice-sheets of South Victoria Land, due to the north and south trend of the lofty mountain ranges, flow towards the east, and the glaciers extend for long distances into the sea in the form of huge tongues of ice, their length varying according to the extent of glaciation due to differences of latitude. Thus, in Robertson Bay (71° 18′ S.), some run out into the sea, for a distance of three miles and are half a mile in width, whilst near Cape Gauss (76° S.) they extend as far out as thirty miles and are four or five miles across. These tongues of ice are characteristic of every glacier. Why should the Great Ice Barrier be an exception?

The huge Parry Range of mountains run parallel with the coast, and appears to be simply a continuation of the coast line, for there is absolutely no land in sight to the east of them. It follows that the ice-sheet which covers these mountains, where the glaciation attains its maximum dimensions, must flow eastwards in the same direction as it does a few miles to the north of them.

If the ice flowed northwards from the South Pole the ice barrier near Cape Crozier would extend out into the sea just as do all the glaciers of South Victoria Land; but this is not so. The edge of the barrier is at least half a mile behind Cape Crozier. Again, the surface of the ice-sheet would gradually rise from the edge towards the south. It does not, but rises

To face page 262.

THE GREAT ICE BARRIER.

from the east towards the west. Then it is evident that the Great Ice Barrier moves from the west towards the east.

Therefore, it appears as if the ice barrier is nothing more than a huge tongue of ice flowing eastwards into the ocean for a distance of perhaps 500 miles, and possibly not more than fifty miles in width ; so that, if the party from the *Southern Cross* that landed on the barrier in Latitude 78° 34′ S. and Longitude 164° 32′ W. had continued their journey farther south they might have come to an open sea on the other side.

The heavy ice-pack met with near this spot tends to prove the existence of a considerable track of ocean to the south, whose frozen surface only breaks up late in the year, and moves out and around the extremity of the Great Ice Tongue or Barrier in the usual north-westerly direction. If an extensive land area were behind, or farther east, such a large mass of sea-ice would be impossible. Sir James Ross reported the "appearance of land" to the south of a spot near where we landed on the barrier. We did not, however, sight any, although we had exceptionally fine, clear weather.

I do not wish to imply that it does not exist; possibly it does, and is either an island or the eastern shore of a large, deep bight extending from Mount Terror towards Graham Land ; but I do believe that there is an open sea between a southern side of the Great Ice Barrier and that land, if it really exists.

There is one thing that appears to go against the above theory, and that is the comparatively shallow water found at the spot where we landed on the barrier, viz., 350 fathoms.*

But can we reasonably expect to find deep water near the

* There appeared to be some doubt about this sounding. The depth is probably less.

South Pole where everything tends to prove the existence of an archipelago of large islands?

The few indications which we possess of the depth of the ocean in this part of the world seem to show that there is a gradual shoaling of the ocean from very deep water towards the Antarctic lands.

The next morning was remarkably cold, with a wind blowing from off the barrier straight from the South Pole; the temperature was 6° below zero Fahr., or 38° below freezing point, an extraordinary low temperature for the time of the year. The lowest observed by Sir James Ross, when sailing along the barrier, was +17° Fahr., and he was there as late as February 23rd.

February 11th. A dense mist lay over the water, which made it impossible to see any farther than the length of the ship. The mist or vapour was in a state of complete congelation, so that the whole ship was covered in frost-rime. This mist was no more than 50 ft. high, and in the crow's nest it was a gloriously fine day, not a cloud being visible in the sky, and the sun shining brightly over the barrier. On deck it was too thick to see anything. All day the temperature remained about 3° below zero. In the afternoon the mist lifted for a short time and enabled us to see Mount Erebus* from the deck. Smoke could be easily distinguished rising from its snow-clad summit, so that it was evidently not quiescent, but whether it was in a state of eruption as at the time of the visit of Sir James Ross, we could not distinguish, being too far away. It was a most cursory and imperfect glance that we got of it, for the dense mist soon closed down again. The light was too bad and the distance too great to procure a photograph of the

* The height according to Ross is 12,400 feet above the level of the sea.

volcano. It is to be regretted that we did not get a better view of this volcano, which is absolutely the loftiest one on the surface of the earth, since it may be assumed that the enormous mass consists for the greater part of eruptive and ejected rocks from the very level of the sea. When Ross saw it in January, 1841, it was in a state of violent activity.

THE COLDEST WORK ON BOARD THE SHIP.

The eruptions took place about every half hour, and on each occasion a cloud of steam and ashes, apparently 150 to 300 feet in diameter, was hurled 1,200 ft. to 2,000 ft. high into the air. When the cloud had disappeared the reflection of the glowing lava could distinctly be perceived; indeed some of the officers thought that they could see streams of lava flowing down until they were lost under the covering of snow.

A few icebergs were seen, the presence of which makes navigation at these times very dangerous. During the night we nearly ran into a huge iceberg, which all too suddenly loomed up across our bows, but the disaster was averted by the calm, vigorous order of the second-mate, Hanson. Starboard! Hard-a-starboard! and the little ship swung round like a yacht, and gently touched the walls of the ice-monster with her long yards. The fog was so dense that we were compelled to stop and lay-to for some time. During the night the temperature sank to 3° 8 F. When the wind changed to E. and N.E. it immediately rose to +17° F. We had now beaten Sir James Ross's farthest south latitude, his being 78° 10′. At noon a meridian observation of the sun gave us 78° 4′ 30″, and at about six o'clock in the evening we were by dead reckoning in latitude 78° 21′ S., having steamed a course nearly due south all afternoon. Of course this gave occasion for some rejoicing in the evening. All the men forward were invited aft, where they revelled in good things. The saloon was decorated with flags; toasts were proposed and drank during the evening, and a speech made by the Commander. The next few days were of a most boisterous nature. A violent gale blew from the south-east, accompanied by a heavy sea and drifting snow. It was intensely cold, and the ship pitched and rolled heavily in the tremendous seas as she was being blown rapidly northwards. The presence of a number of icebergs rendered our position one of imminent danger, for during the thick snow squalls they were quite hidden. It was most exasperating, for we rarely got a sight of the Great Ice Barrier.

The unfortunate dogs penned up forward suffered severely during this bad weather, and were in a deplorable condition;

A TYPICAL ANTARCTIC SEASCAPE.—THE "SOUTHERN CROSS" OFF THE GREAT ICE BARRIER.

some of them we were obliged to shoot. Even when the gale finally subsided, a long deep swell prevailed, which was extremely unpleasant. This persistent thick squally weather was a very great obstacle to navigation, for we were unable to determine our geographical position, and absolutely no reliance could be placed upon the compass, on account of its sluggishness in those high latitudes. Those days in the Antarctic when your little ship is driving through blinding snow, ice, icebergs, darkness and an angry sea, are days of deep anxiety. The remembrance of those experiences makes one almost fear to encourage good and brave men to penetrate those forbidding regions. But it is not all gloom and depression beyond the Polar Circles. Sunshine and lively hope soon return, especially on those days when the sun shines forth with great brilliancy from a perfectly serene and clear sky of a most intense indigo blue, upon those majestic peaks of eternal snow, and you gaze with feelings of indescribable delight upon a scene of grandeur and magnificence beyond anything you have seen or could have conceived.

At about three o'clock in the morning of February 17th we entered an indentation in the ice wall which formed a large bay well sheltered from all quarters, excepting from the north.

The ice-wall, just here, was no longer a barrier, for it fell gradually into the sea, and landing upon it was accomplished without any difficulty. The ice-barrier in this longitude, viz., 164° W., is distinctly different in appearance to that observed further west, near Mounts Erebus and Terror. Its outlines were more broken and full of indentations ; the elevation, too, was no more than 60 ft. or 80 ft. The fact that the position of the ice-barrier where we landed upon it was found to be

some miles further south than reported by Ross is possibly due to a large portion of the barrier having been broken off and drifted away in the form of huge icebergs. Or, again, Ross might not have approached the barrier very closely at this particular spot, his highest south point being thirty miles more to the east.

We moored to the ice, sledges and dogs were lowered over the side, and the Commander, Lieut. Colbeck, and one of the Lapps started upon a short excursion southwards. Just prior to their departure a photograph was procured of the whole of the ship's company upon the ice—an interesting group, for it is taken at the farthest south latitude ever reached by a ship.

The sledge party returned towards one o'clock, having been absent about five hours, and penetrated due south over ten miles across the great ice-sheet, which afforded absolutely no obstacle to travelling, being smooth and level, and but little crevassed. From their turning point farthest south nothing could be distinguished but the great level expanse of ice extending away out of sight to the south.

The temperature during the day was about 2° Fahr. The barometer was low, viz., 28·84 in. and the sea was rapidly freezing. A sounding was taken in the course of the day, which indicated bottom at a depth of 350 fathoms, the lead bringing up with it from the ocean bed a greenish-grey mud. Ross took soundings in between 200 and 300 fathoms a few miles off the barrier. So far as is known no really great depth has been found to exist in the Ross Sea ; the deepest sounding taken by Ross, 2,700 feet without touching bottom, was in Latitude 74° 40′ S. and longitude 166° W., far distant from any known land ; in the neighbourhood of land, on the contrary,

MEMBERS OF THE EXPEDITION FARTHEST SOUTH.

the soundings gave much lower, and at the same time extremely variable, measurements.

Thus the depth about six miles from Cape Adare was found to be 991 feet, while 135 miles east of Cape Phillips, the depth was only 1,082 feet. The greatest depth actually measured descends no farther than 2,450 feet, and this sounding was taken near the edge of the Great Ice Barrier, about 105 miles east of Mount Erebus, while the greatest depth measured nearer land was 2,150 feet, between Franklin Island and McMurdo Bay. A properly organised system of soundings within the Antarctic Ocean, extending right round the globe, will probably throw more light upon the structure of Antarctic lands than would isolated sledge expeditions across their surfaces.

We lay all next day fastened to the ice barrier, waiting for the weather to clear in order to get sights for our geographical position, but not a glimpse of the sun did we get. The ship at this time presented a very wintery appearance, her sides were covered thick with ice, the rigging and yards covered with frost-rime, and from the chains at the bows hung long picturesque icicles, formed by the plunging of the ship in the freezing sea.

February 19th. The following morning, however, was clear and bright; a light wind blew from the south, and the temperature sank to -12° 5 Fahr. (-24° 4 Cent.), and this was February, one of the summer months of the Antarctic regions. A pleasant kind of temperature one would experience there in mid-winter. To all appearance we were frozen up, for what was the day before a dark green moving mass of water, was now a level white plain, firm enough to walk upon.

Very early in the morning, Fougner, Evans, the second

engineer Johansen and I, set out upon *ski* for a spot about five miles to the south where some 200 seals (*Leptonychotes Weddelli*) had congregated. We took with us a sledge and some dogs for carrying the photographic apparatus. The conditions for sledge travelling were splendid. The snow upon the surface of the ice was quite firm; one could easily cover twenty miles a day under such favourable conditions. Indeed, I feel sure that the surface of this ice-sheet or glacier, for as far as we could see, was sufficiently level and firm for the passage of a motor-car. We reached the seals after about an hour's travelling; they were all lying close together in a deep hollow in the ice-sheet which communicated with the sea by way of a crevass in the ice. Among the seals we saw a solitary white species—quite an alien *solas et cælebs*.

After taking some photographs we returned, the steamer having whistled for our recall, and we reached the ship a little before one o'clock. During our absence some crustaceous life, with which the water teemed, had been caught, and Lieut. Colbeck had succeeded in getting capital sights for latitude and longitude.

The observation for latitude of ship gave 78° 34′ 37″ S. and longitude 164° 32′ 45″ W.,* and the magnetic declination or variation of the compass observed on the summit of the barrier was 103° 39′ E.

As the sledge party covered a distance of over ten miles, the farthest south latitude attained may be taken as something between 78° 45′ and 78° 50′ S., or about 40 miles farther south than Sir James Clark Ross in 1842.

At one o'clock we cast off, but we had some difficulty in

* *See* Astronomical Observations at end of Volume for Observations *in extenso*.

ANTON FOUGNER. LOUIS BERNACCHI. H. B. EVANS.

FARTHEST SOUTH.

ramming the ship out through the frozen surface of the sea. Another twenty-four hours and we should have been tightly wedged in for another winter. It was a most timeous retreat. We now directed a course for Franklin Island, which was reached in five day's time. It was intended to take a series of magnetic observations there lasting two or three days, but on account of the tempestuous weather, we found it impossible to land with our instruments, and as the season was considerably advanced, and the weather showed no sign of clearing, it was not deemed advisable to wait. So the ship was headed northwards, homeward bound. The passage from Franklin to Auckland Island was most fearfully boisterous, and took nearly four weeks to accomplish. No ice whatever was met with; the Antarctic Circle was crossed on March 3rd, and soon afterwards heavy westerly and north-westerly gales were encountered, which brought with them a most turbulent sea, and drove us back towards the South. Sometimes one scarcely dared to go on deck for fear of being washed overboard; huge seas swept the decks incessantly, breaking right over the companion-ladder and tumbling below into the saloon and cabins.

At last, on March 21st, Auckland Island was reached, which is situated to the south of New Zealand, in Latitude 51° S. and Longitude 166° E. It is remarkable only for the number of shipwrecks which have occurred there of homeward-bound merchantmen, and for the graves of shipwrecked mariners who have died there of *starvation*. How they could have died of starvation it is difficult to understand, for there are any amount of birds, ducks, wild pigs, rabbits, and even seals, but all very wild and difficult to capture. The vegetation is rich in species, and very dense and stunted.

The climate of the island is abnormally moist, rain falls nearly every day in the year, and in consequence the surface of the ground is everywhere boggy.

Of recent years the New Zealand Government has placed a provision depôt and a boat upon each of those South Pacific Islands, viz., the Auckland, Campbell, and Macquarie Islands, and a steamer visits them once a year ; this is a very desirable arrangement, but nothing short of a light-house upon each of those groups, especially upon the Campbell and Auckland Islands, which lay in the course of ships coming home by Cape Horn, can ensure safety.

We stayed a few days at the Auckland Islands, taking in fresh water, and cleaning up our battered ship.

On the last day of the month we reached Stewart Island, where we spent some most enjoyable days among the kind and hospitable inhabitants. It was pleasant once more to listen to the music of a woman's voice, and to stroll about among the luxurious ferns and wild flowers which cover that beautiful island. It is the want of small luxuries, the loss of domestic society, of music, and the want of something green to look at that constitute some of the small grievances of a polar explorer's life—but there are privations and hardships which are very real. A most hearty reception was accorded us in Hobart and Melbourne during the fortnight we spent in those capitals.

At the end of that period, the scientific staff of the *Southern Cross* took passage for England by the R.M.S. *Ortona*, and arrived home in June of 1900 after an absence of nearly two years.

HOME AGAIN.—THE AUTHOR'S SLEDGE DOG, "JOE."

CONCLUSION.

ALTHOUGH the *Southern Cross* Expedition has not added very much to our actual geographical knowledge of the South Polar regions, it has done some most valuable pioneer work. The scientific observations taken on shore, and covering a period of an entire year (the results of which are about to be published by the Royal Society and the authorities of the Natural History Museum), cannot fail to be a valuable addition to our knowledge of the climate, magnetic conditions, zoology and geology of the Antarctic.

We were the first to prove that a party could winter on shore with comparative safety, and the experiences thus gained may be of some use to our successors.

Two expeditions have just sailed from England and Germany respectively, one under the command of Captain Robert Scott, R.N., in the *Discovery*, and the other under the command of that eminent German explorer and scientist, Dr. E. von Drygalski, in the ship *Gauss*. The former has gone to Victoria Land in what is called the Victoria Quadrant. This route, as Sir Clements Markham, the President of the Royal Geographical Society, has pointed out,* offers the best prospects of securing the main objects of the expedition, with

* "Considerations respecting Routes for an Antarctic Expedition," *Geographical Journal*, Volume XVIII., No. 1.

the best chances of complete success and the minimum of risks.

The German Expedition has chosen the Enderby Quadrant, which extends from the meridian of Greenwich to 90° E.

This appears to be an admirable route for exploration, with an open pack, a sea little encumbered by icebergs, and possibly navigable water along the eastern coast of Enderby Land.

These expeditions have a field for exploration greater than the whole of Australia, and the scientific results which would accrue from the exploration of so extensive and unknown a polar track must be very great ; and surely we cannot boast of any brighter chaplet than that which has been gained in the field of scientific and geographical research.

The advantages to trade and commerce of Antarctic exploration may not be encouraging. The possibility of finding extensive fisheries in those regions is very remote. The remunerative whale fishery carried on during the early fifties in the Southern seas has become nearly, if not quite, extinct. The black whale (*Balæna Australis*) is now rarely seen, and the sperm whales or *cachalots* scarcely repay capture.

Though penguins exist in countless numbers, they are at present of no commercial value. The deposits of guano are not of any great extent, and the idea of discovering a second Eldorado in those regions is very picturesque, but hardly probable.

The exploration of the South Pole is, however, of capital importance to science. The geography of nearly 4,000,000 square miles surrounding the Pole is still a blank. The nature and extent of the Antarctic lands have still to be

determined, and the interior penetrated ; the depth and nature of the ice-cap, and the character of the underlying rocks have to be ascertained.

To take magnetical and meteorological observations both at sea and land, and pendulum observations on shore to determine the force of gravity ; to sound, trawl, and dredge and study the character and distribution of marine organism, and the nature of the ocean floor, and to observe the temperature of the ocean at all depths and seasons of the year. All this is part of the work of a modern Antarctic expedition.

Professor Neumayer, who has so long advocated South Polar exploration, says : "It is certain that without an examination and a survey of the magnetic properties of the Antarctic regions, it is utterly hopeless to strive, with prospects of success, at the advancement of the theory of the earth's magnetism."

Obviously the exploration of so large an unknown area means the advancement of our knowledge of many branches of science.

A dash to the South Pole is not, perhaps, of very great scientific importance, but it is a goal for which most expeditions will strive, just as in the case of nearly every expedition to the North Polar Regions. What is rather desired is a steady, continuous, laborious, and systematic exploration of the whole Southern Region with all the appliances of the modern investigator, and

DISCOVERY

will lead to

DISCOVERY.

PART II.—SCIENTIFIC.

CLIMATE OF THE SOUTH POLAR REGIONS.
TERRESTRIAL MAGNETISM.
ZOOLOGY.
GEOLOGY.
ASTRONOMY.
MISCELLANEOUS NOTES.
GLOSSARY OF ICE TERMS.
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PART II.—SCIENTIFIC.

THE CLIMATE OF THE SOUTH POLAR REGIONS,

BEING A SYNOPSIS OF THE CAPE ADARE OBSERVATIONS.

THE meteorological observations of the *Southern Cross* Expedition have been reduced at the Meteorological Office at the expense of the Royal Society, and revised proof sheets of the results, which cover something like sixty quarto pages, have already been available, without a perusal of which this paper could not have been written. It is intended, I believe, to publish them very shortly in "Philosophical Transactions."

The Cape Adare observations cover a period of nearly one year, namely, from February 18th, 1899, to January 28th, 1900. Cape Adare is situate in Latitude 71° 18′ 0″ S. and Longitude 170° 9′ 30″ E., and is the extremity of a peninsula about twenty miles long, forming the north-eastern shore of a large bay (Robertson Bay).

The latitude of the station is the mean of a series of meridian and circum-meridian observations of the sun taken with a sextant in an artificial horizon, and the longitude is that derived from an occultation of the planet Saturn by the

moon on November 6th, 1899, and observed through a 3½ in. telescope by Ross, Ltd., London. The observations both at Cape Adare and on board ship were made under my personal direction and supervision, and the reading of the instruments, etc., was divided among the following members of the scientific staff:—Messrs. Colbeck, Evans, Hanson, Fougner and myself, all of whom had a thorough knowledge of the instruments and methods employed, and could be relied upon for accuracy, regularity, and honesty.

On board ship observations were taken every two hours throughout the day and night, and during ten months at Cape Adare every two hours from 9 a.m. to 9 p.m. From June 13th to July 31st observations were made every two hours, night and day. The meteorological station was situated on a pebbly bank facing the open sea to the north and west and Robertson Bay on the south and south-west. Behind, to the east and east-south-east, was a range of mountains averaging 3,000 feet in height, the base of which was 1,000 yards from the meteorological screen.

The height of the station above mean sea-level was 19 feet, as determined on the 4th January, 1900, by a series of simultaneous barometric pressure on the ice in Robertson Bay and at the hut.

The instruments employed were all tested at the Kew observatory prior to the departure of the Expedition and again on its return, and most of them gave entire satisfaction.

The observations taken at Cape Adare are possibly affected to a certain degree by local accidents, such as the contour of the country and proximity to the sea. They are taken almost at the centre of the area of lowest mean barometric pressure on the globe, and are the first systematic observa-

tions ever taken on land in so high a southern latitude and covering so long a period, and therefore it is hoped they may prove a valuable contribution to our knowledge of the meteorology of the Antarctic Regions. Meteorological observations for a complete year were also taken by the Belgian Expedition during the years 1898-99 south of Cape Horn, between the parallels 69° 50′ S. and 71° 30′ S. and meridians 87° to 95° W.

Observations during the summer months were taken by Captain Ross in 1841-43, and by Dr. W. S. Bruce in the whaler *Balaena* in 1892-93 and by other expeditions. Yet our knowledge of the climate is very incomplete. Two peculiarities of the climate are strongly expressed, the very low summer temperature and therefore low mean temperature for the year, and the extraordinarily low readings of the barometer. High southern latitudes had long been regarded as having a higher mean temperature than corresponding north latitudes. Recent observations have, however, proved that this idea was not quite correct, being founded, like many other generalizations, on insufficient data. Although the extreme temperatures observed at Cape Adare are not great, the mean summer temperature is the lowest recorded at any station and the mean temperature for the year, $-5°.2$, or, more correctly, for eleven months of the year, is the lowest mean temperature observed for the latitude of 71° north or south. An extensive land area must be necessary to cause such a low temperature.

The following two tables give the normal climatological data derived from the Cape Adare observations :—

NORMAL CLIMATOLOGICAL DATA.

Longitude 170° 9′ 30″ E., Latitude 71° 18′ S. Height above Mean Sea Level 19 feet. Gravity Correction + ·060.

1899-1900.	Mean Pressure at 32° Fahrenheit.	Air Temperature.									Humidity.								
		9 a.m.	9 p.m.	Mean.	Means of		Absolute Min. and Max.				Depression of Wet Bulb.			Tension of Vapour.			Percentage.		
					Min	Max.	Min.	Day.	Max.	Day.	9 a.m.	9 p.m.	Mean.	9 a.m.	9 p.m.	Mean.	9 a.m.	9 p.m.	Mean.
	ins.	deg.	deg.	deg.	deg.	deg.	deg.		deg.		deg.	deg.	deg.	in.	in.	in.	per cent.	per cent.	per cent.
March (28 days)	29·056	18·5	16·6	17·6	13·8	22·0	−2·8	26th	31·1	5th, 6th	1·1	0·8	1·0	·066	·068	·067	67	75	71
April	29·266	10.1	10·0	10·1	5·2	15·6	−10·3	20th	31·5	3rd	0·4	0·4	0·4	·059	·058	·059	86	85	86
May	28·995	−4·3	−3·4	−3·8	−10·6	2·6	−31·5	14th	23·0	5th	0·2	0·3	0·3	·033	·033	·033	93	90	92
June	28·937	−13·1	−12·7	−12·9	−19·3	−4·8	−36·4	4th	13·9	12th	0·3	0·4	0·4	·020	·019	·020	84	79	82
July	29·378	−9·3	−8·8	−9·0	−17·6	−1·0	−39·4	10th	23.6	15th	0·2	0·3	0·3	·026	·025	·026	92	87	90
August	28·993	−13·7	−13·3	−13·5	−22·7	−4·3	**−43·5**	5th,6th	18·7	16th	0·3	0·3	0·3	·019	·019	·019	84	84	84
September ...	·611	−12·4	−12·6	−12·5	−18·8	−3·9	−31·9	13th	11·3	7th	0·3	0·2	0·3	·020	·021	·021	84	90	87
October	28·859	−1·3	−2·6	−1·9	−10·7	4·6	−36·5	1st	19·4	16th	0·4	0·4	0·4	·036	·033	·035	87	86	87
November ...	29·323	18·5	17·5	18·0	9·0	24·1	−4·3	2nd	45·5	29th	0·9	0·8	0·9	·072	·072	·072	72	76	74
December ...	·231	31·9	31·3	31·6	27·5	35·6	20·5	12th	42·0	26th	1·6	1·3	1·5	·144	·145	·145	79	82	81
January (28 days)	29·180	33·5	32·9	33.2	29·7	37·0	25·2	9th	**48·7**	24th	1·7	1·3	1·5	·158	·160	·159	82	85	84
WHOLE PERIOD ...	29·075	5·3	5·0	5·2	−1·3	11·6	−43·5, Aug. 5, 6		48·7, Jan. 24th		0·7	0·6	0·7	·059	·059	·059	82·7	83·5	83·1

NORMAL CLIMATOLOGICAL DATA.

Heights above ground :—Barometer, 2 feet ; Thermometers, 4 feet ; Rain-gauge, 1 foot.

1899-1900.	Amount of Cloud.			Rainfall.			Weather, No. of Days of							Wind, No. of Observations of								
	9 a.m.	9 p.m.	Mean.	Total.	Max.	Day.	Rain*.	Snow.	Hail.	Thunder Storm.	Clear sky	Overcast.	Gale.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
				ins.	ins.																	
March (28 days) ...	7·5	7·6	7·6	0·072	·070	25th	1	4	...	...	1	14	5	0	8	10	8	8	2	2	6	12
April	8·5	7·7	8·1	0·250	·190	6th	2	5	...	...	0	20	5	8†	4	5	9	7	1	2	1	22
May	7·7	6·6	7·2	0·205	·205	8th	1	8	...	...	3	16	5	5	2	3	10	13	1	0	0	28
June	6·4	5·2	5·8	...	...	...	...	5	...	...	4	9	7	1	0	5	10	12	6	0	0	26
July	6·9	5·5	6·2	...	...	...	...	11	...	...	6	12	6	0†	1	7	15	7	0	1	2	28
August	5·5	3·1	4·3	...	...	...	...	6	...	...	9	4	6	1‡	2	2	11	12	1	1	1	30
September	6·5	5·9	6·2	...	...	...	...	9	...	...	5	13	6	1	1	4	18	11	1	1	0	23
October	5·2	5·2	5·2	...	...	...	...	2	...	...	6	12	7	2	0	7	11	7	3	1	0	31
November	4·9	5·1	5·0	...	...	...	...	4	...	...	9	8	6	1	0	2	12	8	2	1	1	33
December	7·7	7·8	7·8	...	...	...	...	5	...	...	2	18	8	3	0	10	11	4	4	2	1	27
January (28 days) ...	8·3	8·1	8·2	0·910	?	?	7	7	...	...	0	15	11	2	1	11	15	4	1	1	2	19
WHOLE PERIOD ...	6·8	6·2	6·5	1·437	...	...	11	66	...	...	45	141	72	24	19	66	130	93	22	12	14	279

* The entries under "days of rain" indicate the number of days when the melted snow amounted to 0·005 inch and upward. Very little *rain* was observed at Cape Adare.

† One observation of whirlwind. ‡ One observation of variable.

The mean temperature observed by the *Belgica* south of Cape Horn was 14°.7 F.—considerably higher than that observed at Cape Adare, but the winter minimum of −45°.6 is lower. The mean pressure observed by the *Belgica* is 29.319 inches, which is also considerably higher than that observed at Cape Adare.

The diurnal variation of the barometer at Cape Adare is almost invisible, and furnishes additional evidence that the diurnal range disappears in high latitudes. The annual variation is, however, comparatively large and somewhat irregular.

The maximum pressure observed occurred at 9 a.m. on July 22nd, viz., 30.156 inches; the barometer remaining above 30 inches for nearly 48 consecutive hours.

The minimum pressure, 27.913 inches, occurred during the night of September 9th. The extreme range is therefore 2.243 inches.

The largest monthly range was in June, viz., 1.633 inches.

The maximum temperature observed was 48°.7 on the 24th January, 1900, during a heavy storm from the E.S.E., and the minimum temperature was −43°.5 on August 5th and 6th.

The extreme range is therefore 92°.2 F.

The largest monthly range was in July, viz., 63°.0.

The relatively high mean temperature for July is due to the large number of gales from the E.S.E., bringing with them a considerable rise in temperature.

The months of August and November were the finest, with clear skies and calm weather. The number of gales being a minimum, and in the latter month the amount of bright sunshine a maximum.

The Antarctic winter on the edge of the great land surface is relatively mild for high latitudes, but the summer is very cold; it is, however, very possible that the winter temperatures in the interior are exceedingly low. On the journey from Cape Adare southwards some remarkably low temperatures were observed for the time of the year. Thus, off Mount Erebus on February 11th, 1900, the temperature sank to −6° F., with a wind from the south straight off the Great Ice Barrier. Again, on February 19th, the minimum temperature was −12°.5 F., with a clear sky and a light wind from the south. So it is possible to form an idea from this what the inland temperatures far south are like.

The mean summer temperature of the South Polar Regions is exhibited by the following tables, which are based on the observations so far made; and it must be borne in mind that the temperature of the sea is considerably higher than that of the neighbouring ice-clad lands* :—

1. Region of Victoria Land (Ross).

Latitude.	Air.	Sea.
60° to 65° S.	30°.38 F.	29°.48 F.
65 to 70	29 .66	28 .76
70 to 74	28 .22	28 .04
74 to 78	24 .98	29 .12

2. Region between Longitude 77° and 99° E. (*Challenger*).

60° to 66°30 S.	30°.92	32°.54

3. Region between Longitude 6° and 58° W. (Ross).

60° to 65° S.	30°.92 F.	31°.28 F.
65 to 71	29 .48	30 .74

Wilkes found that the mean temperature for January and February on the coast of Wilkes Land was 30°.2 F.

It is an interesting problem if we compare these results

* Fricker's "Antarctic Regions."

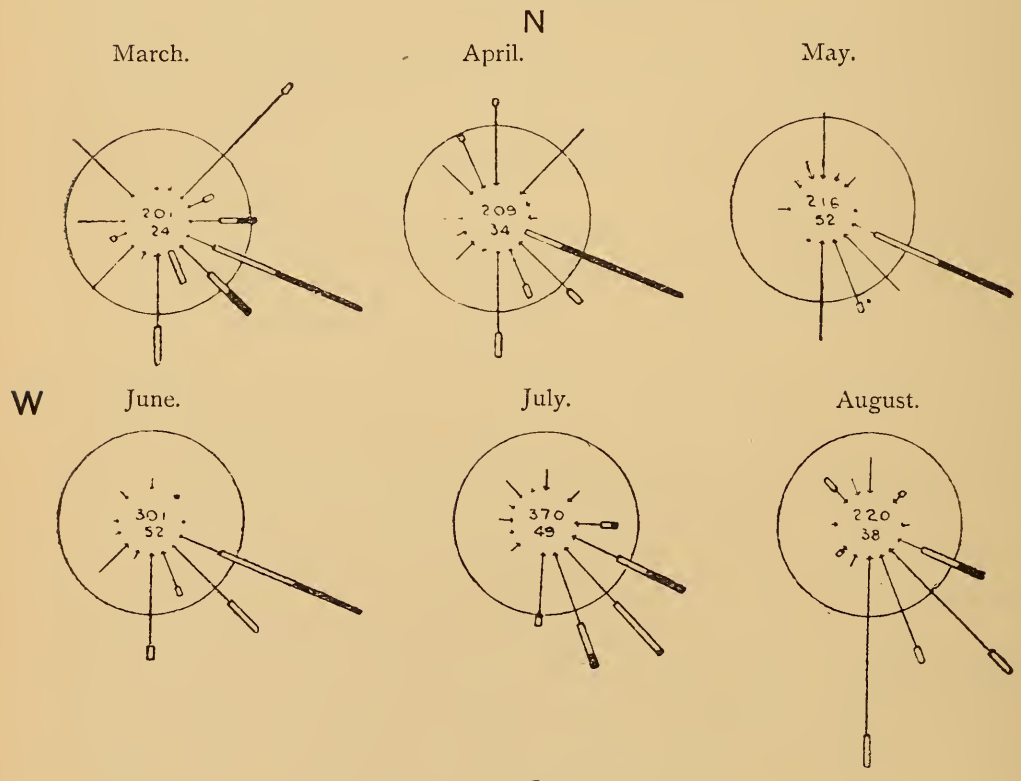
with those from the Arctic Regions. It is a well-known fact that, at all land stations in the North Polar Regions up to Latitude 82°.5 N., we have summer temperatures above 32°, even with the stations on the edge of the inland ice of Greenland. We find in Nansen's account of his journey the following temperatures :—

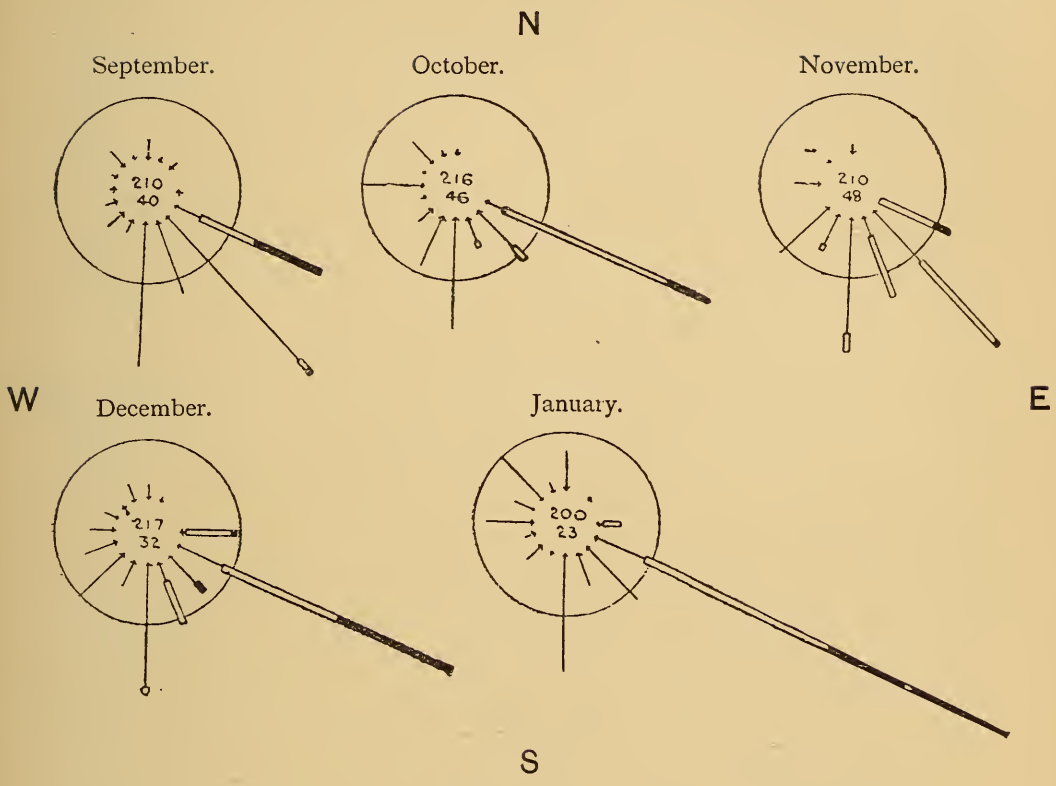
	Mean Summer Temp.
1894 in 81° Latitude N.	30°.6
1895 in 84 ,, ,, ...	28 .8

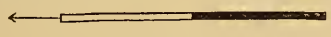
These temperatures are, considering the latitude, incomparably higher than those observed at Cape Adare in Latitude 71° S. and those of the *Belgica* in 70° S.

CAPE ADARE MONTHLY WIND-ROSES.

MARCH, 1899—JANUARY, 1900.





Explanation of wind-rose:—The arrows, which fly with the wind, show, by their length, the frequency of the winds, and, by their thickness, the various forces; light winds, forces from 1 to 3; moderate winds, 4 to 7; and gales, 8 to 12. Light. Gales.  Moderate. The circle supplies a scale for estimating the frequency of winds in any direction. From the heads of the arrows to the circumference represents 5 per cent. of the whole number of observed winds (100 per cent. = 5 inches). The upper figures in the centre of the wind-rose are the total number of observations, the percentage of calms being given underneath.

A mere glance at the Cape Adare Wind-roses show the prevailing winds from E.S.E. and S.E. in a very marked degree. These winds were the most remarkable feature observed in the meteorological conditions of Victoria Land. Their frequency and force, the persistency with which they

blew from the same direction, the invariably high rise in the temperature, their dryness, the motion of the upper clouds from the N.W., and, finally, the gradual rise in the mean height of the barometer to the south of about Latitude 73° S. seem to indicate that the Antarctic Lands are covered by what may be regarded, practically, as a great permanent anti-cyclone, with a higher pressure than prevails over the open ocean to the northwards.

While this anti-cyclonic region may not be characterised by an absolutely high pressure at all seasons, it must be high relatively to the very low pressure which prevails to the northwards.

Sir John Murray, of the *Challenger* Expedition, was one of the first to advance the theory of a vast anti-cyclone covering the South Pole,* and, on a whole, the observations made at Cape Adare, which is almost at the centre of the area of lowest mean pressure, appear to bear out his views.

It is, however, impossible to arrive at anything definite respecting the atmospheric circulation over the Antarctic Regions from observations taken at one station only.

Sir John Murray has said that we might expect the southerly outflowing winds which accompany this anti-cyclone to be dry winds, and attended by a small precipitation. At Cape Adare, the belt of excessive precipitation has been passed; the total amount of precipitation registered during the year being under two inches, and of this the greater part fell in the summer or autumn months, when the ocean to the north was practically free of ice, and the amount

* Address by Dr. John Murray, F.R.S., delivered at a special meeting of the Royal Society on February 24th, 1898.

See also *Geographical Journal* for January, 1894.

of evaporation from its surface at its maximum. During the winter months, however, precipitation generally took place from a practically clear sky, in the form of very minute hard ice-crystals, and in such small quantities as to defy measurement by means of an ordinary snow gauge.

Indications of a rise of pressure towards the pole are afforded first of all by the direction of the prevailing wind, for if the low pressure deepened with increase of latitude toward the South Pole, the prevailing winds over all these high latitudes would be north-westerly and northerly,* just as in the Arctic and sub-Arctic regions where the atmospheric pressure exceeds 30,000 inches, observations show in accordance with this distribution of pressure that northerly winds immensely preponderate. There can be little doubt, however, from the Cape Adare observations, which cover an entire year, that the prevailing winds are from a south-easterly direction. The observations taken by Ross, the *Challenger*, by the Dundee whalers and others during the summer months only, also quite unanimously tell us that in those high southerly latitudes the predominating winds are southerly and south-easterly. The recent expedition of the *Belgica* being, during most of the year, in comparatively low latitudes south of Cape Horn, felt the influence of the westerly wind system; but notwithstanding this the east and south-easterly winds stand out conspicuously. Such surface currents as have been observed in the Antarctic Ocean come also from south and south-east.

On the basis of the observations made by Ross, Dr. Hann†

* *See* Dr. Alexander Buchan's remarks before the Royal Society, Feb. 24th, 1898.

† From Hann's *Handbuch der Klimatologie*, 2nd Edition, 1897, Vol. III., p. 543.

has calculated the mean barometric values of the southern summer in the Ross Sea for the years 1840-41 and 1841-42 as follows:

Lat. S.	60° 67°	65° 71°	70° 75°	75° 78°
Pressure in inches .	29.122	29.031	28.898	28.968

These results indicate the lowest pressure between 70° and 75°.

The mean pressure at 32° Fahr. observed during eleven months (1899-1900) at Cape Adare (which is in Latitude 71° 18′) was 29.075 inches. The mean pressure observed on board the *Southern Cross* during the summer months in the Ross Sea was as follows:

Date.	Latitude.	Mean Pressure.	
Dec. 1898 & Jan. 1899	62° to 65°	29.517 inches	Outward journey
Feb. 1899	67 ,, 71	29.120 ,,	
Feb. 1900	72 ,, 78	29.203 ,,	
Feb. 1900	78 ,, 72	29.061 ,,	Return journey
Feb. and March 1900.	70 ,, 65	28.814 ,,	
,, ,, .	65 ,, 60	29.130 ,,	

These results seem to indicate an increase of pressure towards the pole with the centre of lowest mean pressure in about Latitude 68° S. and Longitude 180° E. These observations, however, taken at sea are not sufficient in number, nor cover a long enough period to be reliable, and we are therefore reduced to discussing only those observations taken at the winter station at Cape Adare, nearly 3,000 in number.

The reason for such a low barometer at Cape Adare is not at first obvious. The exceedingly low mean temperature for the year, and the dryness of the air, by causing the lower strata to become denser and more contracted than when it is warm and moist, ought to cause the barometer to stand high. The prevalence of an upper current (assuming such exists)

setting in from the north-west by compressing the strata underneath, would also tend to raise the pressure.

Maury, in his "Physical Geography of the Sea and its Meteorology," attributed the cause of the low barometer to the excess in the Antarctic regions of aqueous vapour, and its latent heat thus generating a tendency to an upward movement of the air and causing the barometer to fall. The amount of aqueous vapour present in the air over the ocean surrounding the Antarctic lands, especially along the north edge of the immense ice-packs, is very large, but the amount in the air over the surface of these lands is extremely small, it being absolutely dependent on the proximity of free water surfaces for its supply. The climate of the Antarctic lands can not, therefore, be inferred at all, or only to a slight extent, from that of the surrounding ocean, but it must be based on the thermic conditions of the country itself, on the prevailing winds, and finally on the general circulation of the atmosphere over the globe.

Another theory to account for this low pressure area, which is based on the theory of atmospheric circulation, published by the late Professor Ferrel, is that around the South Pole, the high pressure that should result from the low polar temperature is reversed into low pressure by the excessive equatorward centrifugal force of the great circumpolar whirl, and the air thus held away from the polar regions is seen in the tropical belts of high pressure.

The interpretation of this is that the remarkably low pressure region of the southern hemisphere is continued southward to the South Pole itself, the pressure diminishing all the way ; and that in the region of the South Pole, the air currents poured thitherwards along the surface of the sea

ascend, and thence proceed northwards as upper currents of such enormous intensity and volume that they pile up in the tropical regions of the southern hemisphere a mean sea level atmospheric pressure about an inch and a half more than the sea level pressure near the South Pole whence it starts.

It is obvious then that if this theory were true, strong west-north-westerly winds would blow vertically round and in upon the pole, heavily laden, as they necessarily would be, with the aqueous vapour they have licked up from the southern ocean, and would overspread Antarctica with a climate of all but continuous rain, sleet and snow, which would make the exploration of these regions an almost impossible undertaking.

The Cape Adare observations prove, however, beyond a doubt that the prevailing winds over Victoria Land, at least, are from the east-south-east, and the observation of high cirro clouds, invariably moving from a north-westerly direction, seem to point to upper currents blowing towards, and in upon, the polar regions, to make good the drain caused by the surface outblowing south-easterly winds. These surface currents and upper aerial currents are, therefore, diametrically opposed to the requirements of such a theory. If no extensive land surfaces existed round the South Pole, no doubt pressure would decrease right to the Pole, and the great west wind system would whirl round it and actually reach it. The low austral barometer south of Latitude 40° S. is, no doubt, primarily due to the immense track of ocean encircling the globe and the general deficiency of land, thus warming the lower strata of the air and supplying it with large quantities of aqueous vapour.

The pressure then, as we might expect, decreases towards

the south until the influence of the considerable land areas near the South Pole, more especially in the Eastern Hemisphere, makes itself felt, which is, perhaps, in about Latitude 65° S., and the pressure commences gradually to increase until the edge of the land area is reached, when theoretically it should increase very rapidly inland on account of the extremely low surface temperature of these high snow-clad polar lands, and consequently must act as a surface of indraught for the upper currents from the warmer water surfaces about them. Hence the strong contrast in the temperature and hygrometric conditions give rise to anti-cyclonic systems analogous in some respects to those of Australia, which south of 20° S. Latitude are the great controlling force in determining local weather, and frequently cause strong winds from the N.W. on the south-east coast when the girdle of low pressure lies there.

We will suppose, then, as the Cape Adare observations seem to indicate, that the upper currents arising from the surrounding and comparatively warm water-surface flow southward and descend somewhere over the centre of the land surface. Thence would radiate those southerly winds which, owing to the axial motion of the earth are deviated to the left and become south-east winds. As the descending air of the centre of the anti-cyclone connects the inflowing upper currents with the outflowing winds of the surface, it follows that the air filling the centre area of the anti-cyclone is relatively very dry—every stage of its descent adding to its relative dryness, and also becomes warmer by vapour condensation. Those features would also be accentuated by crossing the high snow ranges. An examination of the Cape Adare windroses show that the winds were more concentrated

in the S.E. quadrant during the winter months than during the summer ; winds from other directions were few and the percentage of calms large. Whilst in summer, although the S.E. winds are of longer duration than in winter, the N.W. and S.W. winds are plainly visible ; thus there is a kind of small local monsoon, due perhaps to the warming up by the sun of the bare rocks of the almost perpendicular cliffs.

The fact of the mean pressure being lower during the winter than the summer somewhat points against the existence of a real continental anti-cyclone. However, the maximum pressure 30.156 in. occurred in July (winter), and the mean pressure for that month, viz., 29.378 in. is higher than for any other. The pressure observed at the edge of a land area bordering on a vast track of ocean is scarcely a true indication of the conditions prevailing some distance inland. Perhaps the evidence of the hygrometric and temperature qualities of the S.E. winds will be of some assistance in determining this question.

The following table shows for eleven months of the year 1899-1900, first the total number of winds observed under their respective directions, the mean temperature of those winds, and lastly their pressure :—

The Prevailing Winds.
1056

N. and N.N.E.	E.N.E. and N.E.	E.	E.S.E.	S.E.	S.S.E.	S.	S.W. and S.S.W.	W.S.W. and W.	N.W. W.N.W. N.N.W.	Calms.	Total.	Explanation.
69	64	45	402	251	152	251	105	77	102	1052	2570	Winds observed.
6°.4	4°.7	0°.9	14°.0	8°.8	7°.4	4°.8	3°.9	16°.0 ?	11.5			Thermal Wind-roses.
inches 29.123	inches 29.167	inches 29.155	inches 28.953	inches 29.087	inches 29 058	inches 29.111	inches 29.134	inches 29.242	inches 28.993			Pressures.

Examining the table we see at once the immense preponderance of what we will call the anti-cyclonic winds, viz., from E.S.E to S., over all other winds.

Of the 2,570 observations taken during eleven months 41.1°/₀ are south and south-easterly winds, 41°/₀ calms, and the balance 17.9°/₀ winds from other directions. The strongest winds, and also the most frequent, were from the E.S.E. Gales were experienced on 72 days, or on 20°/₀ of the total number of days.

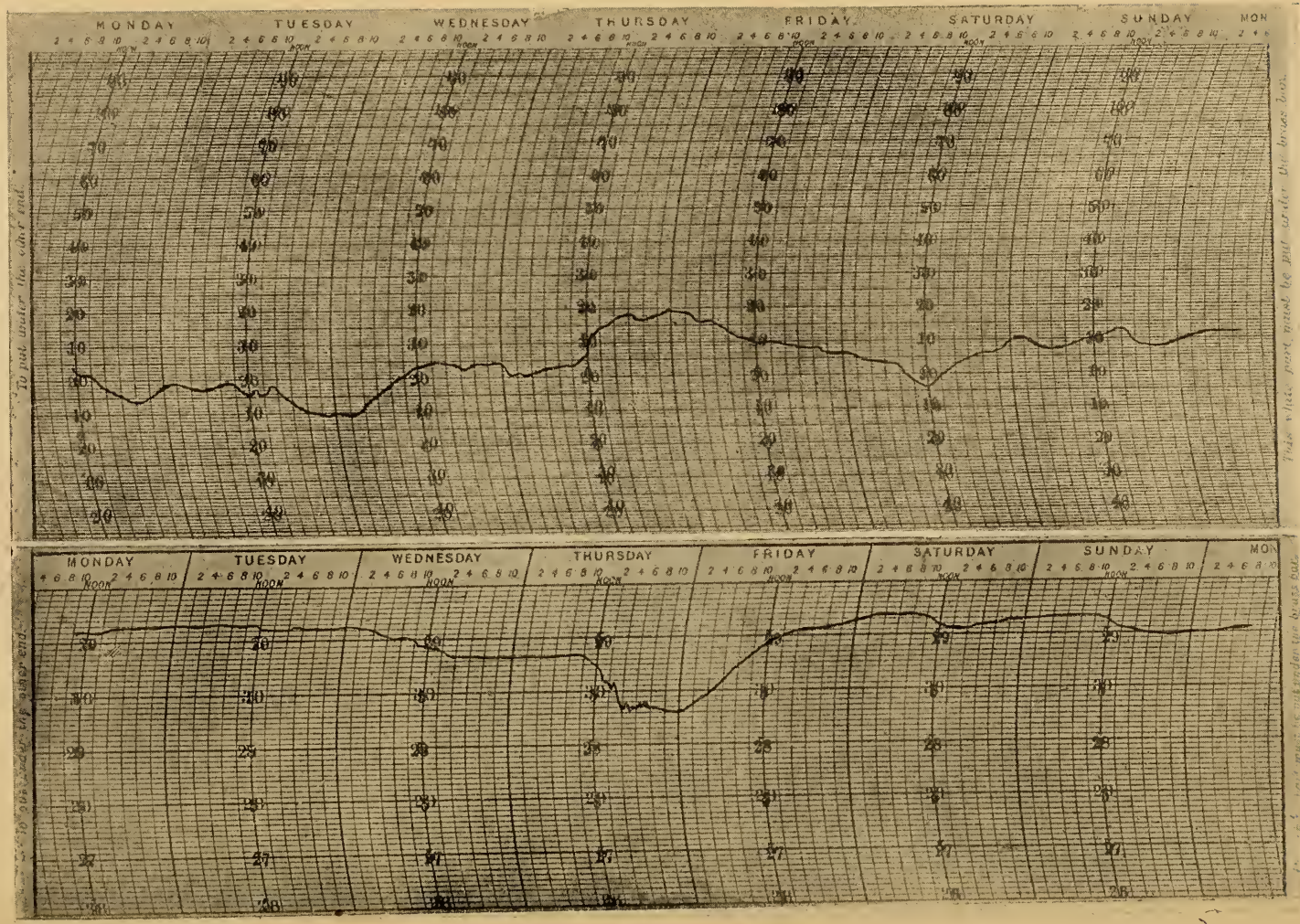
The great potency of these south-easterly winds, blowing at times with a velocity above 90 miles an hour (as determined by Robinson anemometers subsequently demolished by the force of the wind), indicates a very steep barometric gradient towards the interior of Victoria Land. Looking now at the thermal wind-roses which show the mean temperatures of the winds, we find that the strongest and most frequent wind has also the highest temperature.

The mean temperature of the air for the eleven months being +5°.2 Fahr. ; the amount this E.S.E wind raises the mean temperature is 8°.8 Fahr. This power of raising the temperature is more conspicuous in the winter time than in the summer. Thus the mean temperature for the month of July is −9°.0, while the mean temperature of the E.S.E. winds for that month is +7°.6, a difference of 16°.6 F. Such a contrast is very striking. The power that this wind has in raising the temperature is perhaps better shown in the following table of single storms.

Date 1899.	Min. Temp. previous 24 hours.	Max. Temp. during subsequent gale.	Degrees Raised.
	Deg. Fahr.	Deg. Fahr.	Deg. Fahr.
March 17	16·5	30·1	13·6
April 23 to 24	5·1	30·0	24·9
May 18-19	−21·1	13·8	34·9
June 20	−19·4	11·4	30·8
July 25-26	−35·8	7·8	43·6
August 15-16	−25·4	18·7	44·1
September 6-7	−23·2	11·3	34·5
October 14-16	− 5·1	19·4	24·5
November 26-28 ...	8·6	45·6	37·0
December 4-6	27·1	41·8	14·7
1900.			
January 19-24	25·6	48·7	23·1

The coldest weather prevailed during calm clear days and also with light S.W. winds.

Turning to the mean pressures for each wind, we see that the lowest barometric pressure is the one with the highest temperature, viz., E.S.E. The deviation of the mean pressure for the E.S.E winds (28.953 in.) from the mean pressure for the year (29.075 in.) is 0.122 inches. In the month of June the mean of the barometric readings for this wind was 0.344 in. lower than the mean pressure for that month. It will be noticed that the barometer rises as the wind moves round from E.S.E. to S.E., and falls again when the wind is from the S.S.E., and then rises towards the south. This is shown in a very marked degree in some of the monthly means. The low mean pressure for the N.W. winds is due to the wind generally blowing from that direction just prior to a south-easterly gale. The following diagram shows in a graphic manner the effect of a south-easterly storm in raising the temperature simultaneously with the fall of the barometer :


MONDAY
TUESDAY
WEDNESDAY
THURSDAY
FRIDAY
SATURDAY
SUNDAY
MON
Noon
To put under the other end.
This white part must be put under the brass bar.

Thermograph and Barograph Curves from May 1st to 8th, 1899 :

For correcting curves.

Mercury barometer at 11 a.m. on 1st .....29·278 inches
,, ,, at 9 a.m. on 8th.....29·214 ,,
Thermometer in shade at 11 a.m. on 1st ..... 0°.6 F.
,, ,, at 9 a.m. on 8th .....16·7 ,,

Although the above Curve does not give correctly the absolute temperature and pressure, it being slightly in error, it shows very plainly the great variations in pressure and temperature which take place during a south-easterly storm.

The prognostics of an approaching storm from a south-easterly direction were as follows :—Generally a gradual and simultaneous rise of temperature and fall of the barometer some hours previous ; frequently, however, only a rise in temperature with little warning from the barometer. A very rapid fall of the barometer about thirty minutes before the bursting of the storm, with light, variable winds, and, occasionally, strong whirlwinds loaded with drift-snow ; then a dead calm for a few minutes, followed by a great rush of wind from the E.S.E., having a velocity of about sixty miles an hour, and bringing with it for the first few hours masses of drifting snow from the mountains. The sky above, however, was usually clear.

During the course of the storm the wind frequently dropped quite suddenly and a perfect calm ensued, which lasted a few seconds, then the rush of wind would come again with redoubled fury. During the winter months most of the storms ended as abruptly as they had commenced, and sometimes the minimum barometric pressure occurred just as the storm ended, but the barometer would take nearly twenty-four hours to recover. The summer storms were less

severe, but were of much longer duration, lasting on one occasion a whole week.

It is, of course, premature to give a truly satisfactory description of the prevailing winds and temperature conditions in high southern latitudes. Until one year observations at numerous stations on the Antarctic Lands are available, it is impossible to form an accurate idea of the climate. The Cape Adare observations will, it is hoped, make our knowledge of a less hypothetical nature than heretofore.

TERRESTRIAL MAGNETISM.

THE magnetic observations taken at Cape Adare by Lieut. Colbeck and myself during the year 1899-1900 have been reduced and are being fully discussed for the Royal Society of London by Dr. Charles Chree, F.R.S. Only the briefest outline of the work can be given here. The observations were, at first, thought to be unsatisfactory on account of the disturbances, but now that they have been reduced and all the corrections applied, the results prove that there was really no ground for such a deduction; indeed, considering the difficulties under which the observations were taken, and the smallness of the horizontal force in high latitudes, the results compare very well with results obtained at a properly-equipped magnetic observatory.

The instruments employed at Cape Adare were a large unifilar Magnetometer made by Dover, England, and a Barrow Dip Circle. The latter circle was fitted with Lloyd's needles for observing the Total Force, but they were never used. The magnetic elements observed were the Declination, Absolute Dip, and Absolute Horizontal Force, from which can be calculated the Vertical and Total Force. We had no self-recording apparatus or system of Variometers for registering the diurnal variation in the before-mentioned three elements. The constants for the Magnetometer were determined at the Kew Observatory before the expedition left England.

On account of the weak horizontal intensity, in the deflexion observations for the moment of the magnet distances 39 centimetres and 52 centimetres had to be used, instead of 30 centimetres and

40 centimetres, and in the vibration observations every third transit instead of every fifth was observed.

The following tables give an idea of the results obtained. The figures given are subject to small alterations :—

TABLE I.—HORIZONTAL FORCE. C. G. S. Units.

Date 1899.	No. of observations.	Mean value of X.	Mean value of m.	Mean value of X′.	Mean value of m′.
April	9	.04105	817.4	.04092	820.1
May & June	10	.04094	816.7	.04083	818.9
October ...	7	.04162	810.6	.04151	812.8
November...	15	.04170	811.1	.04159	813.3
December, 1900 & January	6	.04151	808.7	.04140	810.8
Means	47	.041364	810.9	.041250	815.2

X=Horizontal component of the earth's magnet force.
M=Magnetic moment of the deflecting or vibrating magnet.

TABLE II.—MAGNETIC DECLINATIONS.

Date, 1899.	No. of Observations.	Mean Declination.
April	14	56 5′° 2″ East.
May	9	55 44′° 22″ ,,
October	8	54 52′° 40″ ,,
November	15	55 29′° 33″ ,,
December, 1900 and January	11	56° 40′ 12″ ,,
Means	57	55° 46′ 22″ East.

TABLE III.—MAGNETIC INCLINATION.

Date, 1899.	No. of Observations.	Mean Inclination.
March and May.....	8	−86° 35′ 7·5″
September and October	10	−86° 34′ 51.3″
November	13	−86° 34′ 16.8″
December	8	−86° 33′ 10.2″
January, 1900	6	−86° 34′ 36.6″
Means	45	−86° 34. 24.5″

An examination of the Tables shows an increase in the horizontal force and a decrease in the declination towards the spring months; this, however, might be only accidental. The diurnal variation of the intensity is not by any means large, but the variation in the declination sometimes amounted to as much as three degrees. Besides the above observations, magnetic dips were observed at some different places as follows :—

Date.	Latitude.	Longitude.	Dip.	Remarks.
1899 January 2	63° 41′ S.	160° 16′ E.	−83° 18′ 53″	Taken in the ice-pack
,, 3	63° 40′	160° 36′	83° 7′ 41″	Taken in the ice-pack
1900 March to January	71° 18′	170° 9′	86° 34′ 24″	Mean of 45° at Cape Adare
February 4	73° 17′	168° 31′	87° 18′ 25″	14 miles due W. Coulman Island
,, 6	74° 23′	164° 3′	88° 2′ 37″	Taken at the foot Mount Melbourne
,, 8	75° 18′	163° 32′	87° 47′ 16″	Taken on ice-barrier
,, 8	75° 42′	163° 29′	87° 34′ 51″	Taken on ice-barrier
,, 9	76° 12′	168° 20′	86° 52′ 13″	Taken on Franklin Island

The dip observations taken along the coast of Victoria Land are smaller than the values observed by Ross in 1841, and indicate that the magnetic pole (of verticity) is farther inland towards the west than it was sixty years ago.

A detailed magnetic survey of Victoria Land and the surrounding ocean would be of immense value—of infinitely greater value than the determination of the spot where the needle stands vertical.

In order to make such a survey it would be necessary to take observation surrounding the magnetic pole and to have a base station where self-recording instruments could be erected which would give an idea of the variations taking place in the magnetic forces.

ZOOLOGY.*

BIRDS OF THE ANTARCTIC.

PENGUINS.

The Emperor Penguin (*Aptenodytes Forsteri*): A gigantic penguin nearly four feet high, and weighing between 50 lbs. and 80 lbs. The upper parts of the birds are bluish-grey, the head to the throat black, with a yellow patch on each side of the head shading into white on the neck; the under parts are white. It is rarely seen farther north than Latitude 63° South, but some have been seen by the *Southern Cross* Expedition as far south as 78° S. At Cape Adare, specimens were procured both in summer and in winter. They were generally solitary, or in small groups of five or six. Its food consists principally of crustaceans. Great pains have been taken to find any clue to the breeding place of the Emperor Penguin, but unsuccessfully.

The King Penguin (*A. patagonica*): A penguin very similar to the Emperor, and has frequently been confused with its larger relative. The two species, however, may be distinguished from one another by their size. The general colour of the upper parts in both is bluish-grey, but in the Emperor, a yellow semi-circular patch on each side of the head shades into white on the throat, whereas in the King, orange-yellow bands on the sides of the neck join the orange on the throat, to large yellow patches on each side of the nape; both have slender shaped bills, decurved at the tip.

* Only vertebrates are here dealt with. The authorities at the Natural History Museum, London, are publishing an elaborate report on the zoological specimens collected by the *Southern Cross* Expedition.

The King Penguin has never been found *within* the Antarctic Circle, but is found in great numbers on the islands lying just *outside* the circle, viz., the Kerguelen, Marion, Heard, Crozets, Stewart and Macquarie Islands, where they are known to breed.

Adélie Land Penguin* (*Pygoscelis adeliæ*): the smaller blunt-billed, black-headed species found in immense rookeries on Victoria Land and Adélie Land, as well as in the area around Louis Philippe and Graham Lands. Length, 30 inches; weight, about 12 lbs.

Gentoo or Johnny Penguin (*Pygoscelis papua*): similar to the above, but with a white band across the crown from behind the eyes. Found in the Falkland, Marion, Kerguelen and Heard Islands.

Ringed or Bridled Penguin (*Pygoscelis Antarctic*): also similar to the above, but the grey of the upper parts bluer than in preceding species; throat white with a thin blackish "bridle" from under the chin, ear to ear.

Gorfoo or Rock-hopper (*Catarrhactes chrysocome*): The Crested Penguins have a very wide range of distribution, especially the Rock-hopper, which is found from the Tristan da Cunha group to the Cape Seas, the Marion, Crozet, Kerguelen and St. Paul Islands, and the South Australian and the New Zealand waters, as far as Campbell Island in 52° 33′ S. The upper parts of the penguin are dark slate-colour; top of the head black, with a crest of feathers elongated to 3 inches; a golden-yellow eyebrow stripe of similarly elongated feathers along the sides of the crown. The chin and throat is dull black, but the rest of under parts white.

Macaroni Penguin (*Catarrhactes chrysolophus*): generally similar to above, except that the yellow eyebrow stripes are wider, and join on the forehead. Found breeding on South Georgia, also in the Falklands, and eastward to the Heard Island.

Jackass Penguin (*Spheniseus magellanicus*): restricted to the seas of South Africa and South America; found breeding on the Falk-

* *See* Chapter VIII. of Narrative for full description of this Penguin.

lands and South Georgia. The forehead, crown and nape is black, shading into slate-grey on the rest of the upper parts; chin, throat and cheeks black, with broad white stripes enclosing the last, and a broad black band across the white breast. Length, 28 inches.

PETRELS.

The species of petrel especially characteristic of the Antarctic seas is the graceful snow-white Ice Petrel (*Pagodroma nivea*), with jet black eyes, feet and bill. It is rarely found far from the ice, although it has been obtained as far north as the Falkland Islands. It breeds among the crevices of the cliffs of the Antarctic Lands.*

Wilson's Storm Petrel* (*Oceanites oceanicus*) is among the few species which occur within the Antarctic Circle. This bird is slightly larger than the familiar "Mother Carey's Chicken," from which it can be distinguished by its unusually long legs, and the bright yellow colour of the webs between the toes. Its colour is sooty-black above and below, with greyish-white edges to the wing coverts and inner secondaries. These petrels were found nearly as far south as the Great Ice Barrier, and were seen resting on the cliffs at Cape Adare.

The brown-backed Antarctic Petrel (*Thalassœca antarctica*, sometimes placed in the genus *Priocella*) was found as far south as Latitude 78° S. It has a brown mantle and head, with broad white edges to wing coverts and secondaries; the tail is white, tip brown; under parts white. Length about 17 inches. Very little is known of its breeding place. At Cape Adare they were seen early in November, flying in large flocks towards the south.

The Silver Grey Petrel (*Thalassœca Glacialoides*) is also seen very far south. The head and neck of this bird is pale grey, mantle rather darker, tail pale grey, length about 18 in. Its breeding place is probably Kerguelen Island.

The well-known Cape Petrel, or "Cape Pigeon" (*Daption Ca-*

* *See* Chapter VIII.

pensis), was occasionally seen within the Antarctic ice-pack and even at Cape Adare. It, however, does not seem to care to cross the ice. It is an exceedingly handsome bird. The head, neck and throat are blackish. The feathers of the mantle are mainly white, but tipped with black. The tail is broadly tipped with black. The under parts are white. It is a bird widely distributed all over the Southern seas.

"The Cape Hen" (*Majaqueus acquinoctialis*) is a sooty black bird, about 20 inches in length, with a variable amount of white on the chin and upper throat, sometimes around the eye. It is very common in the Cape seas, but rarely seen south of Latitude 60° south.

The Giant Petrel (*Ossifraga gigantea*), which approaches the larger species of Albatross in size, we frequently saw during the summer at Cape Adare and even down near the Great Ice Barrier. The adult bird is a uniform dark chocolate-brown, but immature birds exhibit more or less white in their plumage, while nearly pure white individuals are not uncommon. The length of the bird is about 34 inches. The breeding place is on the Marion, Kerguelen, South Shetland, South Georgia and numerous other islands.

The small grey Prions, with boat-shaped bills and known to sealers as "whale-birds," seldom go beyond the northern edge of the great antarctic ice-pack.

The Great Wanderer Albatross (*Diomedea exulans*) are common in the Cape seas and even to the edge of the ice-pack, but they very rarely go beyond. One, however, was seen far south, near the ice-barrier, by the *Southern Cross* Expedition in February of 1900, when most of the pack-ice had already drifted north and had disappeared.

The Sooty Albatross (*Phœbetria fuliginosa*) was occasionally seen in the ice-pack during the month of January, 1899. This bird has a wide range in the Southern ocean, and like the Great Wanderer, breeds on the Marion, Crozets and Kerguelen Islands. In appearance, the plumage is generally sooty, paler and greyer on the

shoulders and the under surface, and a white ring surrounds the eye. The tail is long and wedge-shaped. Length about 36 inches.

GULLS.

The only gull which is common within the Antarctic circle, is the predaceous and aggressive McCormick's Skua* (*Megalestris Maccormicki*), named after its discoverer, Dr. McCormick, of Sir James Ross's Expedition, who obtained specimens on Possession Island, Victoria Land. These birds breed on the Antarctic Lands, and a very fine series were obtained by the *Southern Cross* Expedition, from the downy nestling upwards. In colour the mouth, wings and tail of the bird are chiefly umber-brown. The crown is olive-brown and the feathers of the neck strongly marked with golden straw colour. The claws are exceedingly sharp and curved. A larger and darker bird (*Megalestris antarctica*) is found on the South Shetlands and Cockburn Islands.

A gull which approaches the Antarctic circle is the southern Black-backed gull (*Larus Dominicanus*), which is recorded by McCormick as breeding at Cockburn Island, and was obtained by Captain Fairweather, of the *Balaena*, in Latitude 64° 18′ south. The mantle of this bird is sooty black, the head, neck, tail and under surface are pure white and the bill is yellow.

There is ample evidence that Terns are found in large numbers in the South Polar regions. Few, however, were seen by the *Southern Cross* Expedition.

ANTARCTIC SEALS.†

Only four species of true seals are known to exist within the Antarctic circle, although there are many other species frequenting the outlying islands. One of the first seals to be met with on enter-

* See Chapter VIII.

† It is to be deplored that the voluminous notes made by the late Mr. Nicolai Hanson, zoologist to the expedition, have, since his death, disappeared.

ing the pack-ice is the crab-eating or white seal (*Lobodon carcinophagus*), which is a seal common during the summer months, in the pack-ice, and even seen far south towards the Great Ice Barrier, but rarely met with near the shores of the Antarctic lands. In appearance this seal varies somewhat; or, more correctly speaking, its colour varies according to the seasons of the year, and also according to the age and sex of the animal. The long old winter coat is creamy white, hiding almost completely the mottlings on the shoulders and flanks and sides of the head. During the early part of January the seal commences to moult, discards its old coat, and by the end of the month emerges with a beautiful silky grey-brown coat, with richly-marked mottlings. The body of this seal is not rounded like the Weddell seal, but rather slim and slightly flattened out when lying on the ice. It is rather solitary, pugnacious when disturbed, and feeds principally on *Euphausia*.

The only young procured of this seal was one killed near its mother in Robertson Bay on the 29th of November, 1899. It was the only one we saw during the fourteen months we spent within the Antarctic Circle. It was by no means so far developed as the young of the Weddell seal, which were quite common. The following are the dimensions of the calf of this white seal:—

Length, 4 feet 11 inches;
Girth round flippers, 2 feet 5 inches;
Girth round hips, 1 foot 9 inches.

The Weddell seal, or false sea-leopard (*Leptonychotes Weddelli*) is found in great numbers along the coasts of the Antarctic lands, but rarely in the pack-ice. As many as 200 of these seals were seen together by the *Southern Cross* Expedition, even at the farthest point south reached by the ship. In the depths of winter it is still to be found near open pools of water around large icebergs, which are kept open by the movements of the bergs. In appearance it is the most *rounded* of all the Antarctic seals, with a bullet-like head

and large and prominent dark-brown eyes, which appear blood-shot and protruding, though always full of expression. It is slow, quiet, and very inoffensive. The staple food of this seal is crustaceous matter and small fish. In colour the back and sides are dark grey, shading off into a tawny orange colour underneath. They were found breeding in considerable numbers in Robertson Bay during the spring of 1899, the first young appearing early in September.

The true sea-leopard *(Stenorhynchus leptonyx)* is readily distinguished by the great size of its elongated body, by its large, flat square head, with small fierce and slit-like eyes set sloping inwards, and by the greater number of spots upon its body than any of the other species. It is not a common seal, for only three or four specimens were secured by the *Southern Cross* Expedition. It is the largest and fiercest of all the seals, not hesitating to attack a man on being molested. It is a most voracious animal, and feeds upon fish and penguins. I have seen one near Possession Island give chase to a penguin in the water; the latter appeared to have little chance against such a determined and rapidly-moving foe. In colour the back is of a dark hue, but the most characteristic point seems to be the presence of black as well as tawny spots on the grey of the upper part of the sides. The young of this seal is born during the month of September.

The least-known of all the Antarctic seals is the Ross seal *(Ommatophoca Rossi)*. Only a few specimens of it have ever been procured, four of these by the *Southern Cross* Expedition. Of its breeding habits nothing is known. It has, however, a very wide distribution, having been found on the pack-ice in the neighbourhood of Victoria Land *(Southern Cross)*, Alexander Land *(Belgica)*, and by Dr. Bruce near Joinville Island and Louis Philippe Land. In colour the back is greyish-brown, and under the belly silver-grey, with lighter spots in the division. A specimen I saw soon after it had been shot appeared to me distinctly slate-colour; this specimen measured nearly eleven

feet in length. The eyes were very large, and underneath the chin was a most extraordinary protuberance or sack, which is evidently inflated when the animal is angered. The greatest interest centres in the skull, which is quite different to that of any other known seal. The dentition is exceedingly feeble; of two skulls procured by the *Southern Cross*, one had no molar teeth whatever, and the other six molars on each side in the upper jaw, and five on each side in the lower.

The food of this seal is much the same as that of the Weddell and crab-eating seals. The remains of octopus were found in the contents of the stomach examined by Mr. Hanson.

ANTARCTIC CETACEA.

Surprisingly few whales were seen during the cruise of the *Southern Cross* in the Antarctic Seas. The Southern right whale (*Balœna Australis*) was not seen at all within the Antarctic Circle, although Sir James Ross, during his famous voyage in the *Erebus* and *Terror* (1841-43) recorded meeting with numbers of what he regarded as right whales, or "black whales," in high Southern latitudes. Doubtless, Sir James Ross had only come across the summer haunts of the same whales, which were then undergoing the process of ruthless extermination in their winter breeding places on the Australian and New Zealand coasts. It is stated that in 1843, the whale fishery on the New Zealand coasts alone employed eighty-five boats and some 730 men, and the oil taken amounted to 1,200 tons, valued at £20,000, the whalebone being valued at £12,000.* After this period, the decline in the take became very rapid, due, no doubt, to the cruel and foolish practice of killing the young whales or "calves," so as to more easily capture the mothers. The affection of the whale for her young became the principal cause of its destruction. The whalers soon discovered that if the "calf"

* *See* Address on "Whales, and British and Colonial Whale Fisheries," by Sir William H. Flower, K.C.B., F.R.S., before the Royal Colonial Institute, January 8th, 1895.

was wounded or caught the mother would never leave it, and they found that the calf, though of no value in itself, being inexperienced and slow, was easily captured, and then the mother became a sure prey. Literally, the goose that laid the golden egg was being killed.

The right whale is, however, still numerous in the New Zealand seas; two were captured by the *Southern Cross*, at Campbell Islands, during the winter of 1899. But to-day, whale fishing in the Southern Seas is not remunerative.

The Southern right whale, although no doubt it occasionally travels far south, is distinctly not an ice-whale, analogous in its habits and distribution to the Greenland right whale; indeed, none of the Southern whales appear to be exclusively denizens of the circum-polar ocean. It attains about the same length as the Arctic right whale viz., from 45 to 50 feet, but differs in being more slender in form, in possessing a smaller head in proportion to the body, shorter baleen (scarcely more than half the length), a differently shaped contour of the upper margin of the lower lip, and a greater number of vertebræ.

It can generally be distinguished when in the water by the entire absence of a back fin.

The Sperm whale or *Cachalot* (*Physeter macrocephalus*) cannot come under the heading of Antarctic Whales, for it is met with in herds or "schools" as they are termed, in almost all tropical and sub-tropical seas, but only accidentally in the Polar Regions, nevertheless, an account of the Southern whales would be incomplete, without mention of this gigantic denizen of the ocean. In bulk and weight, it is the most colossal of all animals.* The sperm whale is a strange looking animal, and cannot be mistaken for any other cetacean. The head is about one-third of the whole length of the animal, very massive, high and truncated in front, and owes its

* The best account of this whale is to be found in Mr. Bullen's book "The Cruise of the *Cachalot*."

huge size and remarkable form mainly to the great accumulation of a peculiar form of oily matter, contained in great cells, connected with the nasal passages, and filling the large hollow on the upper surface of the skull.

This oily matter, liquid at the natural temperature of the body, crystallises when cold, and yields when refined the spermaceti of commerce, so valuable in the manufacture of surgical ointments and candles. The nostril or "blow-hole" is single, in the form of a longitudinal slit, and placed, not near the top of the head, as in most other cetaceans, but near the front end of the great snout, and rather to the left of the middle line. Consequently the "blowing" of the sperm whale is so different from that of all other species that the whalers can recognise it at any distance.

The steamy jet, instead of being double and projected directly upwards, as in an ordinary fountain, which is the case with all the large whalebone whales, is single and directed obliquely forward. The opening of the mouth is on the under side of the head, considerably behind the end of the snout. The general colour of the surface is black above and grey below, the colours gradually shading into each other. The food of the sperm whale consists mainly of various species of cephalopods (squids and cuttlefish), but they also eat fish of considerable size. About fifty-five feet seems to be the usual length of the male sperm whale.

Ambergris, formerly used in medicine, and now in perfumery, is a concretion formed in the intestine of this whale, and often found floating on the surface of the seas it inhabits. Its genuineness is proved by the presence of the horny beaks of the cephalopods, on which the whale feeds. It is exceedingly valuable, being worth about £6 per ounce. Some years ago two poor Tasmanian fishermen found some hundredweights of this valuable substance, which realised some thousands of pounds.

Of the many inferior cetaceans which habitually frequent the southern ocean very little is known. Another right whale is the

pigmy whale *(Neobaloena marginata)*, a species peculiar to the seas of Australia and New Zealand, and only grows to a length of about twenty feet. It may be recognised by its white "bone."

The most common whales seen in the Antarctic regions are the Humpback whales *(Megaptera)*, so called by whalers on account of the low, hump-like form of the dorsal fin, and the rorquals, or finners *(Baloenoptera)*, but there is practically no definite information available as to the species to which these belong. One of the rorquals, frequently seen within the pack-ice by the *Southern Cross* Expedition, was an exceedingly large blue whale which, but for the dorsal fin, might have been mistaken for the Southern right whale.

There are many other species of small whales, dolphins and porpoises of the Southern oceans, about which our knowledge is extremely imperfect.

GEOLOGY.*

The Antarctic Lands being, for the most part, completely buried under a pall of ice and snow, are not regarded as a hopeful field for geological work. But though the conditions may be unfavourable, the geological problems of the Antarctic are exceptionally interesting. The conception of a great *terra Australis incognita* has been proved to be equally erroneous with the conjecture that no land whatever, or of only trifling extent, was to be found. It has been proved that extensive masses of land exist within the Antarctic Circle; but whether this land takes the form of a vast continent, or an archipelago of islands smothered under an overload of frozen snow which conceals their insularity, or islands whose shores are washed by the ocean, remains still an enigma, and a fascinating one to be solved by future expeditions. It is, I think, premature to call it the "Antarctic Continent," for explorations on the American side and even on that of Australia, tend to prove the existence of a broken-up continuation of these two continents with the most extensive masses of land lying under their respective meridians. The coasts of Wilkes Land and the Balleny Islands appear to be a duplicate of the Australian Coast—so the gigantic mountain range to which the coast of South Victoria Land rises, seems to correspond to the mountain chain of New Zealand; and as part of the South Australian Coast is at least of Lower Cainozoic age, we may hope for marine deposits of the same age on the northern face of the Antarctic Lands. That Palæozoic

* The geological specimens collected by the *Southern Cross* Expedition have been fully discussed by Mr. J. T. Prior of the Natural History Museum, and will shortly be published.

sediments and limestones occur there is now certain, and they ought to yield fossils if the right zones are exposed. In a recent number of *Nature*, Professor J. W. Gregory states that the more ancient Antarctic rocks, viz., the granite and slates, collected by the *Southern Cross* Expedition, are "practically identical with some of the Lower Palæozoic rocks of Victoria." The character of the volcanic rocks of South Victoria Land gives support to Ritter's suggestion that the volcanic chain of the latter is the continuation of the volcanic line which passes through New Guinea, New Caledonia and New Zealand. The volcanic extremity of the Cordilleras of South America finds its counterpart in the broken and scattered island masses also bearing volcanoes to the South of Cape Horn. The prolongation of the volcanic ring or "circle of fire" from New Zealand to Balleny Islands, South Victoria Land, and right across to the American side, seem to support the theory of the connection at one time of the Antarctic Lands with America and Australia. Professor Arçtowski, of the *Belgica* Expedition, has suggested that "Graham Land is connected with Patagonia by a submarine ridge, which forms a great arc extending between Cape Horn and the South Shetland islands, and that the tertiary chain of the Andes reappears in Graham Land."

The *Southern Cross* collection consists mainly of specimens of basalt and of a pale green slate and quartz-grit, together with boulders of granitic rocks. This granitic rock probably constitutes the basement rocks of Victoria Land just as it does in parts of Australia.

The only sedimentary rocks* found were the pale-green slates and quartz-grits from the shores of Robertson Bay, and through which in comparatively recent geological times were erupted the hornblende-basalts which constitute the main mass of Cape Adare, Possession Island, etc. Of volcanic rocks, besides the basalts, there occur (probably in far less amount), also phonolitic rocks very similar to rocks from the Canary Islands and the Rift Valley of East Africa.

* See Chapter VII. for full description of sedimentary deposits.

ASTRONOMICAL OBSERVATIONS.

The climate of the Antarctic regions is scarcely favourable for the taking of Astronomical observations. Even in a temperate climate, if the work has to be done in the open air, it is frequently trying for the observer, and in a climate like that of a high Southern latitude it is positively painful, especially during the dark winter months, when only stars are available for an accurate determination of Local Mean Time. The latitude of Cape Adare, namely, 71° 18′ 0″ South, is that determined from a series of Meridian and Circum-meridian observations of the sun by Lieut. Colbeck, R.N.R., and myself. The observations were very carefully taken with two ten-inch sextants, made by Cary, London, in an artificial mercury horizon. The sextants during the observations were not held in the hand, but fixed on stands. The mean of Lieut. Colbeck's observations taken during October, November, December and January was about 71° 17′ 56″. The mean of my own observations gave about 71° 18′ 5″, and the mean of the two sets was accepted as the correct latitude of the "huts" at Cape Adare. This result is certainly not more than 4″ or 5″ in error. In reducing the observations Bessel's Refraction Table was employed, and even the error for "eccentricity" of the sextant was applied. The determination of longitude was a more difficult matter, and no really satisfactory observation was made.

Capt. Ross, in 1841, determined the longitude of Cape Adare, at some distance from it, to be 170° 45′ E., but this value is

certainly too large. A total lunar eclipse on June 23rd, 1899, gave a longitude of 170° 15′ E. Unfortunately, the edge of the earth's shadow is so indistinct that it is impossible to note the critical instants with any degree of accuracy.

An occultation of the Planet Saturn from the dark limb of the moon on November 6th, 1899, furnished a more reliable longitude.

The following is the observation, with the necessary data for reducing it:

The occultation was observed through a 3½ inch telescope, made by Ross, Limited, London. The moon was in the south-west, about ten degrees above the horizon. The temperature of the air at the time was + 15° F., Barometer, 29.302, in Attached Thermometer, + 22°. Immersion, $11^h\ 30^m\ 11^s$ by Chronometer.

Error of Chronometer on Local Mean Time $16^m\ 50^s$ fast.

Latitude of Cape Adare	71° 18′ 0″ S.
Geocentric Latitude .	71° 10′ 30″.
G. M. T. of observation . .	$23^h\ 52^m\ 48^s$ on 5th.
Semi-diameter of moon for G. M. T. =	15′ 49″ ·75
Horizontal Parallax ,, ,, ,, =	57′ 59″ ·63
Semi-diameter of Planet . . =	7″ · 1
R. A. of Moon . . . =	$17^h\ 22^m\ 47^s$ ·58
R. A of Saturn . . . =	$17^h\ 22^m\ 52^s$ ·70
Declination of Moon . . . =	23° 6′ 9″ · 5
Declination of Saturn . . . =	22° 5′ 24″ · 4

With the above data the longitude can be determined, viz., 170° 9′ 30″ E.

The rate of the chronometers was determined in the winter time by star altitudes with the sextant two or three days every month; four or five observations being made in rapid succession, and the mean of the results taken. In the summer months, there being no stars visible, the sun had to be used.

At midnight, on November 29th, the Horizontal and Vertical

diameters of the sun were very carefully measured by Lieut. Colbeck. The mean of three sets gave :

Horizontal diameter = 32′ 16.65″.
Vertical diameter = 29′ 53.50″.

The sun was about 1½° above the horizon, Temperature of the air 27.5° F., Barometer, 29.60 in.

Navigation in the Antarctic Seas is frequently a difficult matter on account of the persistently overcast days, and therefore the few opportunities of getting midday observations of the sun. An exceedingly useful and simple method of finding one's latitude when the sun is on the Prime Vertical is given in Chauvenet's work on Spherical and Practical Astronomy, and I should think one of great utility to navigators in these high latitudes, where it is often impossible to get a sight of the sun at or near the meridian for days at a time. The observation simply consists in noting the interval in time that the sun takes to change its altitude equal to its own diameter. The following is the reduction of an observation taken in an artificial horizon at Cape Adare on November 23rd, 1899 :—

	h.	m.	s.
First contact (upper limb) =	5	39	12.5
Second contact ,, =	5	45	58.0

d s=diameter of sun (in seconds of arc) taken from Nautical Almanac for Greenwich Mean Time.

d t=interval in seconds between first and second contacts.

Then :—

^{d}s = 1947.8″ = Log	...	3.289544
^{d}t = 405.5^{s} = Ar. Co. Log		7.392010
Constant Log $\frac{1}{15}$ =	... ...	8.823900
Log Cosin ϕ ...	...	9.505454
= 71°. 19′ 20″ S.		

The sun was just past Prime Vertical, therefore there is a correction to subtract. This result is sufficiently accurate for any purpose at sea.

The following observations were made by Lieut. Colbeck, R.N.R. at the farthest point south attained by the ship *Southern Cross.*

The observations were taken in an artificial mercury horizon on the summit of the Great Ice Barrier.

Date, February 19th, 1900.

Latitude—

Maximum altitude of sun	= 46°	26′	20″	
Index error of sextant		−	20″	
Apparent altitude	23°	13′	00″	
Refraction and parallax	−	2′	4″	
Semi-diameter of sun	−	16′	12″	
True altitude	22°	54′	44″	
Zenith distance	67°	5′	16″	
Declination of sun	11°	29′	21″	
Latitude	78°	34′	37″	South

Longitude—

Altitudes of sun's U.L.	= 38°	53′	40″	
	38°	56′	40″	
	38°	59′	20″	
Mean	38°	56′	33″	
Index error		−	20″	
Apparent altitude	19°	28′	7″	
Refraction and parallax	−	2′	32″	
Semi-diameter	−	16′	12″	
True altitude	19°	9′	23″	

Time by watch	=	7^h	20^m	17^s A.M.
,,		7	20	49
,,		7	21	32
Mean		7	20	52.7
Watch slow on chronometer		+	40	56.8
		8	1	49.5
Chronometer slow on G.M.T.		+	3	23.0
Greenwich Mean Time		18^d	8^h	5^m 12.5^s

Longitude—(continued.)

True altitude . .	= 19°	9′	23″		
Latitude . . .	= 78°	34′	37″	secant	0.703221
Polar distance .	= 78°	26′	4″	co-secant	0.008908
	176°	10′	4″		
	88°	5′	2″	cosine	8.524217
	68°	55′	39″	sine	9.969940
					9.206286

Hour angle	3h	9m	5.5s	
Apparent time at place =	18d	20h	50m	54.5s
Equation of time . .		+ 14		7.0
Mean time at place . =	18	21	5	1.5
Greenwich Mean Time	18	8	5	12.5
Longitude in time .	12h	59m	49s	
Longitude in arc . . =	194°	57′	15″ E.	
Correction		+ 30′	0″*	
	195°	27′	15″	
Longitude west . .	164°	32′	45″	

Magnetic Declination—

Sun's true azimuth N. . . . =	49°	39′	E.
Bearing by prismatic compass N.	54°	0′	W.
Declination . . .	103°	39′	E.

* I do not now recall the reason for the last correction of + 30′. It had, I believe, something to do with the error of the chronometer, but I am not sure. I regret I have not had time to communicate with the observer about it.—THE AUTHOR.

MEMBERS OF THE *SOUTHERN CROSS* ANTARCTIC EXPEDITION.

Wintered in the Antarctic Regions.

C. E. Borchgrevink, F.R.G.S.	*Chief.*
Sub-Lieut. W. Colbeck, R.N.R. (extra master) ...	*Magnetic Observer and Cartographer.*
Louis Bernacchi, F.R.G.S.	*Physicist.*
*Herluf Klövstad, M.A., M.D.	*Medical Officer.*
†Nicolai Hanson	*Zoologist.*
Hugh Blackwall Evans	*Assistant Zoologist.*
Anton Fougner	*Scientific Assistant.*
Kolbein Ellifsen	*Assistant.*
Ole Must	*Norwegian Lapp.*
Persen Savio	*Norwegian Lapp.*

Bernhard Jensen ... *Sailing Master of the "Southern Cross."*

‡Jorgen Petersen ...	*First Mate.*
Hans Hansen ...	*Second Mate.*
J. Cristian Olsen ...	*First Engineer.*
Julius Johanesen ...	*Second Engineer.*
Klemet Klemetsen ...	*Boatswain.*
Hans Ulis	*Carpenter.*
Lars Andersen ...	*Steward.*
Carl H. J. Been ...	*Fireman.*
Karl Brynildsen ...	*Fireman.*
Johannes Jahnsen ...	*Cook.*

Franz Johan Magnüssen ...	*A.B.*
Oscar Bjarko	*A.B.*
Ingvard Samuelsen ...	*A.B.*
Hans J. Johnson	*A.B.*
Johan A. Andersen ...	*A.B.*
Olaf Larsen	*A.B.*
Lars A. Larsen	*A.B.*
Adolf M. Karlsen.	
Axel Johansen.	

THE SHIP *SOUTHERN CROSS.*

The *Southern Cross* was built at Arendal in Norway after a design by Mr. Colin Archer, who designed and superintended the building of Nansen's ship, the *Fram.* She was barque

* Died soon after the return of the Expedition of nerve fever.
† Died During the spring of 1899 at Cape Adare.
‡ Died in September, 1900, on the voyage from Australia.

rigged, round-sterned, and had two decks. The following are her dimensions :—

Gross Tonnage	521.7 tons.
Net Tonnage	276.7 tons.
Length	146.5 feet.
Breadth	30.7 feet.
Depth of Hold	17.6 feet.
Draught	18 feet.

The engines and boilers were made by I. & A. Jensen, of Fredrikstad, Norway, and were of the vertical expansion type, and in calm water could drive the ship at about nine knots per hour. The propeller had only two blades and was ten feet in diameter, and when in danger of being damaged by ice could be raised on deck through a well.

ANTARCTIC OUTFIT FOR ONE MAN.

JAEGER WOOL CLOTHING.

1 fleece suit (unsuitable).
4 fleece sleeping bags.
6 pairs fleece shooting gloves (unsuitable).
4 Cardigan jackets.
12 pairs stockings.
12 vests.
12 shirts.
12 pants.
4 blankets.
2 pairs slippers, fleece lined.

The Jaeger wool clothing is the very best that can be recommended for underwear, but it is absolutely useless as an outer covering, as it allows the wind to penetrate and gathers the snow.

FUR CLOTHING, ETC.

1 militza (type of fur coat with fur turned inwards).
1 Sovike with hood and gloves (coat with fur turned outwards).
1 Samoyede young reindeer skin fur cap (extremely useful).
2 pairs wolfskin gloves, with gauntlets.
1 reindeer skin sleeping bag for winter use.
1 brown leather Swedish jacket.
1 white duffle suit, Hudson Bay pattern, for summer use.

BOOTS, ETC.

1 pair fur-lined sea boots.
1 pair plain rubber boots.
1 pair Erie-cut flannel-lined short boots.
3 pairs sea boot hose.
3 Lapp *komargar;* reindeer skin boots filled with grass (the best type for polar wear).
3 pairs *ski-ing* boots (very useful).
1 pair Canadian snow-shoes.
2 pairs Norwegian *ski.*
2 pairs long fur boots.
2 pairs Arctic socks for rubber and sea boots.
2 pairs skin stockings.
3 pairs knitted mits.

MISCELLANEOUS.

1 ice axe.
1 Alpen stock, steel shod.
1 Wallace spade, pick and hammer.
1 bowie knife.
1 pocket knife, containing corkscrew, tin opener, cartridge extractor, etc.
1 broad leather belt, containing pipe case, compass, whistle, burning glass, flint and steel, and ring for knife.
2 pairs snow goggles.
1 water bottle covered with thick felt.
1 small yard measure.
1 housewife fitted.

GLOSSARY OF ICE TERMS USED THROUGHOUT THE BOOK.

BARRIER.—The edge of the great Antarctic glaciers or ice-caps which enter the sea, but remain attached to the land. They sometimes extend out into the sea many miles from the shore, and are generally from 80 to 200 feet in height above the water.

BESET.—The situation of a ship when closely surrounded by ice.

BLINK.—*Ice-blink:* a peculiar whitish glare in the sky along the horizon over a large surface of ice which is too far distant to be visible.

Water-blink, or *Water-sky:* a dull bluish-grey appearance of the sky over open water, seen from a distance when beset in the ice.

BRASH ICE. -- Small fragments and nodules, generally formed by the colliding of large masses of ice during a storm.

CREVASSE.—A crack or rift in a glacier or ice-sheet, sometimes of considerable width and great depth, and very dangerous when hidden from sight by a thin cake of snow.

DRIFT SNOW.—Snow blown from the surface of the ground by the wind and drifting before it. At the sea-level in Victoria Land this drift-snow was generally blown down from the heights above, and was, therefore, not *snowfall* at the sea-level.

DRIFT ICE.—Small masses of ice drifting about in the sea.

ERRATIC BOULDER OR BLOCKS.—Portions of rocks, usually iceworn, which have been transported by ice from their original positions and deposited perhaps hundreds of miles away at a place where sometimes the nature of the rocks is totally different.

GLACIER.—A river of solid ice, descending from its source in the high *névé* of a snowfield.

HUMMOCK.—A rough hillock of ice, whether formed by *séracs*, pressure ridges, or otherwise.

ICEBERG.—A large mass of land ice broken from a glacier or edge of an ice-cap and floating in the sea. In the Antarctic Regions usually tabular in form, and of stupendous dimensions.

ICE CLIFF.—*See* BARRIER.

ICE CAP.—A continuous covering of ice, *névé*, or snow.

ICE FIELD.—A sheet of ice of such extent that its termination cannot be seen from the crow's nest of the ship.

ICE FLOE.—A sheet of ice on the surface of the sea, the termination of which can be easily seen from the ship.

ICE FOOT.—The term "ice-foot" has been used in the book to denote the extremity or snout of an ice cap which can be followed for great distances along the coast, the surface of which is perfectly level and uninterrupted by land obstacles. Strictly speaking, the term "ice-foot along a coast" means something quite different.

INLAND ICE.—An ice-cap of very great extent, and sometimes many hundreds of feet deep.

LAND ICE.—Ice attached to the land, either in floes or in heavy ground masses lying near the shore.

LANE.—A narrow track of open water between portions of pack-ice or floes.

LATERAL MORAINE.—A ridge of rock débris along the side of a glacier.

MEDIAL MORAINE.—A ridge of rock débris running more or less along the middle line of a glacier and formed by the coalescence of the *interior* lateral moraines of *tributary* glaciers.

NIP.—The situation of a ship when forcibly pressed by ice on both sides. She is then said to be nipped.

PACK (ICE).—A huge body of drifting ice masses driven together by wind and currents, sometimes many hundreds of miles in extent.

PANCAKE ICE.—Consists of small circular pieces caused by striking one another on every side in a ruffled sea.

ROTTEN ICE. — Old ice, partially melted, and in part honeycombed.

SLUDGE ICE. —Small pieces of brash ice saturated by the salt water.

TONGUE.—Used in the book to express a long mass of glacier ice running out in the sea for a considerable distance, but attached to the land.

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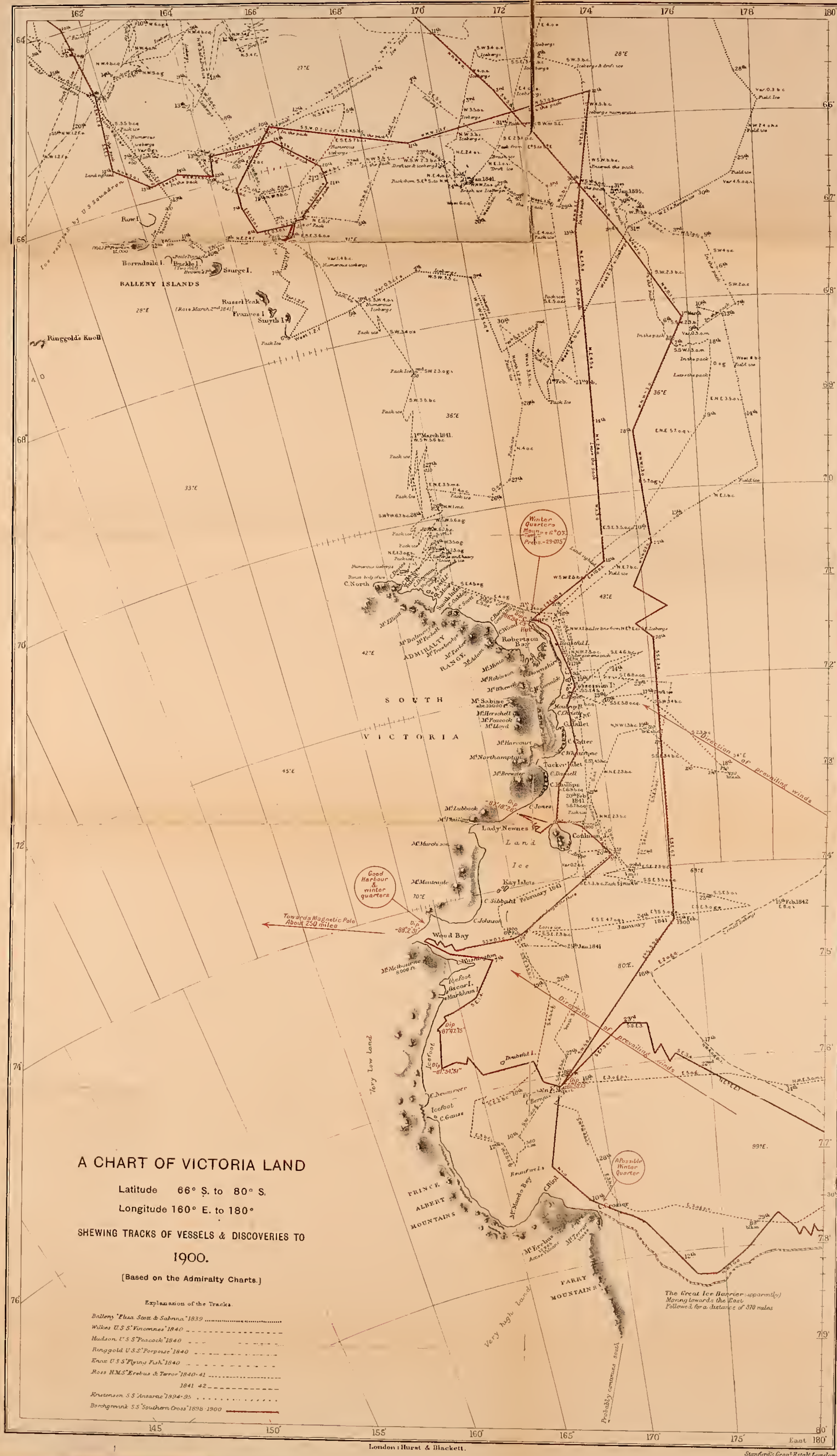

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